Rotational crop sensitivity to fall-applied Valor. Jenks, Willoughby, and Hoefing. The objective of this study was to determine the sensitivity of spring-planted crops to fall-applied Valor. Valor was applied at 2 and 3 oz/A on September 11, October 16, and November 4 in 2008. Dry pea, lentil, chickpea, and flax were planted in mid-May of 2009. The study area was hand-weeded for broadleaf weeds and grasses were controlled with a postemergence application of Select Max. Thus, weeds had no effect on crop yields.

Very little crop response was observed with any crop or treatment. There were no treatment differences in yield or test weight for any crop.

Table. Rotational crop sensitivity to fall-applied Valor (0927).

			Chickpea			Flax			Lentil			Chickpea		Flax		Lentil		Dry pea	
Treatment[a]	Rate	Timing	Jun 13	Jul 08	Jul 22	Jun 13	Jul 08	Jul 22	Jun 13	Jul 08	Jul 22	Yield	TW	Yield	TW	Yield	TW	Yield	TW
		(2008)	% injury									lb/A	lb/bu	lb/A	lb/bu	lb/A	lb/bu	lb/A	lb/bu
Prowl H2O	2 pt	Sept	0	0	0	0	0	0	0	0	0	2699	62.5	35	54.7	1483	58.9	3250	66.7
Valor	2 oz	Sept	0	0	0	0	0	0	0	0	0	2434	61.7	38	54.3	1417	58.6	3004	66.5
Valor	2 oz	Oct	0	0	0	0	0	0	0	0	0	2758	60.1	31	54.4	1626	59.1	2781	66.6
Valor	2 oz	Nov	2	0	0	0	0	0	0	3	0	2965	60.2	37	54.4	1894	59.3	3255	66.6
Valor	3 oz	Sept	1	0	0	0	0	0	0	2	0	2836	60.4	43	54.5	1596	58.6	2814	66.6
Valor	3 oz	Oct	4	0	0	0	0	0	0	2	0	2777	59.9	37	54.5	1529	58.8	2747	66.5
Valor	3 oz	Nov	6	0	0	1	0	0	0	4	0	2842	60.1	37	54.2	1769	59.2	2591	66.8
LSD (0.05)			2.3	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV			88	0	0	529	0	0	0	158	0	8	4	13	1	21	1	12	1

[a] *No dry pea injury was observed in any treatment*

Follow crop response to Saflufenacil. Howatt, Roach, and Harrington. Treatments were applied near Fargo in the fall of 2008 with a tractor sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzles to an area 20 ft wide the length of 25 by 30 ft plots. Bioassay strips of '8N 386CL' sunflower, 'Finch' safflower, 'Beta 4554R' sugar beet, 'IS 3057RR' canola, 'York' flax, and 'Admiral' field pea were seeded perpendicular to treatment direction near Fargo in rows 3 inches wide on May 29. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Spray volume	6/15 All species	6/29 All species	7/13 All species
	oz/A	gal/A	%	%	%
Paraquat+NIS	6+0.25%	17	0	0	0
Saff+MSO+AMS	0.26+1%+24	8.5	0	0	0
Saff+MSO+AMS	0.36+1%+24	8.5	0	0	0
Saff+MSO+AMS	0.72+1%+24	8.5	0	0	0
Glyt+MSO+AMS	12+1%+24	8.5	0	0	0
Glyt+Saff+MSO+AMS	12+0.26+1%+24	8.5	0	0	0
Flumioxazin+MSO+AMS	5.7+0.25G+24	8.5	0	0	0
Glyt+Flum+MSO+AMS	12+1+0.25G+24	8.5	0	0	0
Untreated	0		0	0	0
CV			0	0	0
LSD 5%			0	0	0

Treatments were applied to sunflower canopy as a preharvest desiccant. Possible residues of saflufenacil and flumioxazin may have been present, but there was not any indication of residual treatment effect on any of the species in the study area.

Crop response to Saflufenacil preemergence. Howatt, Roach, and Harrington. 'York' flax, 'IS3058RR' canola, '8N 386CL' sunflower, 'Finch' safflower, and 'Admiral' field pea were planted in 3 foot wide bioassay strips near Fargo on May 28. Preemergence treatments were applied May 29 with 68°F, 46% relative humidity, 0% cloud cover, 6 to 7 mph wind at 225°, and damp soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzles to an area 21 feet wide the length of 25 by 25 ft plots. The experiment was a randomized complete block design with four replicates.

		6/15	6/15	6/15	6/15	6/15	6/29	6/29	6/29	6/29	6/29
Treatment	Rate	Flax	Field pea	Canola	Sunflower	Safflower	Flax	Field pea	Canola	Sunflower	Safflower
		%	%	%	%	%	%	%	%	%	%
Saflufenacil	0.18	3	0	10	22	18	13	0	27	50	30
Saflufenacil	0.36	8	0	15	47	27	40	0	33	75	43
Saflufenacil	0.72	8	0	27	73	60	50	0	60	92	88
Pyroxasulfone	2.8	0	0	3	0	0	0	0	10	0	7
Untreated	0	0	0	0	0	0	0	0	0	0	0
C.V.		68	0	64	28	50	60	0	40	19	51
LSD 5%		5	0	13	15	20	23	0	19	15	32

Field pea did not demonstrate a response to saflufenacil. All other crops exhibited substantial injury as a result of saflufenacil soil residues. Expression of injury generally worsened as the season progressed, mainly because plants in control plots continued to grow at a normal rate. Saflufenacil did not cause significant plant death in the susceptible crop species over the duration of the study but condition continued to decline. Pyroxasulfone caused minimal injury across these crop species and may be a viable candidate for further development.

Metribuzin use in alfalfa. Howatt, Roach, and Harrington. An established alfalfa plot was treated May 21 with 54° F, 61% relative humidity, 0% cloud cover, 10 mph wind at 360°, and moist soil at 52°F. Wild mustard (coty to two-leaf, 5 to 10 plants/ft^2), field pennycress (two- to four-leaf, 15 plants/ft^2), shepherd's-purse (two- to four-leaf, 10 plants/ft^2) and common lambsquarters (two- to three-leaf, 10 to 50 plants/ft^2) were present. All treatments were applied with a backpack sprayer delivering 17 gpa at 40 psi through 8002 TT nozzles to an area 7 feet wide the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	5/28 Alfalfa	6/4 Alfalfa	6/16 Alfalfa	6/16 Wimu	6/16 Fipc	6/16 Shpu	6/16 Colq
	oz/A	%	%	%	%	%	%	%
Metribuzin-CN[a]	16	6	2	3	99	94	86	90
Metribuzin-CN	32	11	5	4	99	97	96	96
Metribuzin-DF	16	4	2	2	99	97	90	87
Hexazinone	16	9	5	4	99	95	86	91
Imazamox+MSO+UAN	0.5+0.187G+16	2	0	0	99	97	77	82
Untreated	0	0	0	0	0	0	0	0
CV		32	35	31	0	4	9	7
LSD (P=0.05)		2	1	1	0	5	9	7

[a] Two formulations of metribuzin were included. CN was not commercially available. DF was available as Sencor.

All herbicide treatments caused visible injury to alfalfa 7 DAT. Alfalfa recovered quickly from imazamox injury that was observed as slight chlorosis. Metribuzin and hexazinone injury persisted as small necrotic lesions on a small percentage of leaves in the upper canopy. The injury did not slow growth or development but was present until first cutting. Injury was not observed on alfalfa regrowth. All herbicides provided excellent control of wild mustard and field pennycress. Shepherd's-purse and common lambsquarters were not controlled as well by imazamox as they were by metribuzin or hexazinone. Metribuzin formulation did not provide different weed control and alfalfa response marginally differed between the two formulations.

Weed control with sulfonylurea herbicides. Howatt, Roach, and Harrington. IS3057RR canola was planted May 22. Treatments were applied June 24 with 68° F, 61% relative humidity, 0% cloud cover, 1 to 3 mph wind velocity at 270°, and damp soil at 63° F. Treatments were applied to six- to eight-leaf canola, cotyledon to eight-leaf wild mustard (10 to 50/yd^2), two- to five-leaf wild buckwheat (2 to 10/yd^2), cotyledon to 5-inch redroot pigweed (50 to 100/yd^2), 2- to 5-inch common lambsquarters (5 to 20/yd^2), and spike to two-leaf yellow foxtail (20 to 50/yd^2). Treatment following (/) was applied July 10 with 66° F, 73% relative humidity, 80% cloud cover, 4 to 7 mph wind velocity at 270°, and moist soil at 67° F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzles to an area 7 feet wide the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/30 Canola	6/30 Wimu	6/30 Wbw	6/30 Rrpw	6/30 Colq	6/30 Yeft	7/11 Can	7/11 Wimu	7/11 Wibw
	oz/A	%	%	%	%	%	%	%	%	%
Glyt[a]+NIS+AMS	6.4+0.25%+12	0	80	67	89	85	50	0	86	87
Glyt+NIS+AMS/ Glyt+NIS+AMS	6.4+0.25%+12/ 6.4+0.25%+12	0	80	75	91	89	55	0	87	87
Glufosinate[b]+AMS	7+48	85	85	90	95	90	80	89	90	86
Thif&trib[c]+clet[d]+NIS	0.45+1.4+0.25%	70	70	55	69	37	27	94	96	92
Thif&trib+nico+NIS	0.45+0.6+0.25%	70	70	62	70	35	30	97	98	96
Imazamox+NIS+UAN	0.5+0.25%+32	65	65	60	67	37	30	92	95	89
Thif-sg[e] +NIS	0.45+0.25%	65	65	52	69	42	30	91	93	91
Thif&trib+NIS	0.45+0.25%	65	65	62	71	32	27	93	95	92
Thif-sg+trib-sg+NIS	0.34+0.11+0.25%	65	65	57	70	37	27	91	91	87
Thif-sg+trib-sg+NIS	0.36+0.09+0.25%	65	65	62	67	37	27	92	93	91
Quin+thif&trib+NIS	0.71+0.22+0.25%	70	70	55	71	40	32	91	91	90
Quin+thif&trib+NIS	0.71+0.45+0.25%	70	70	55	67	40	25	91	92	91
Quin+thif&trib+clet+NIS	1.76+0.45+1.4+0.25%	70	70	57	70	35	25	93	94	92
Thif-sg+trib-sg+clet+NIS	0.36+0.09+1.4+0.25%	70	70	52	71	37	25	91	91	89
Thif-sg+trib-sg+nico+NIS	0.36+0.09+0.6+0.25%	70	70	62	71	37	32	95	96	94
Primisulfuron+NIS	0.75+0.25%	70	70	60	72	40	32	91	92	87
Untreated		0	0	0	0	0	0	0	0	0
C.V.		8	7	10	5	9	14	2	2	3
LSD 5%		7	7	9	5	6	7	2	3	4

[a] Glyphosate as Buccaneer from West Central.
[b] Glufosinate as Ignite from Bayer CropSciences.
[c] Thifensulfuron&tribenuron formulation provided by study cooperator.
[d] Clethodim as Select Max from Valent.
[e] Soluble granule (-sg) formulations provided by DuPont.

Glufosinate initially provided the best control because of rapid desiccation of exposed tissue. Glyphosate also gave better control of some species at the first evaluation than most of the treatments. After the first evaluation, plots treated with glufosinate, imazamox, or primisulfuron were easily discernible because of the number of surviving plants that resumed growth. Imazamox control held fairly well with at least 70% control of each species. Primisulfuron had particular difficulty with wild buckwheat and common lambsquarters. And glufosinate allowed substantial survival and regrowth of many species. Lack of canola competition was a distinct factor for glufosinate. This must be considered when comparing any of the treatments with glyphosate which benefited from exceptional crop competition. Canola was not present in any of the other herbicide treatments because SU-resistant canola was not available for this study, yet broadleaf control was excellent with treatments containing thifensulfuron and tribenuron. Clethodim provided 94% control of yellow foxtail and nicosulfuron gave 88 to 90% control while control with primisulfuron was only 81%.

Table continued.

Treatment	Rate	7/11 Rrpw	7/11 Colq	7/11 Yeft	7/22 Canola	7/22 Wimu	7/22 Wibw	7/22 Rrpw	7/22 Colq	7/22 Yeft
	oz/A	%	%	%	%	%	%	%	%	%
Glyt[a]+NIS+AMS	6.4+0.25%+12	97	91	95	0	97	95	99	96	97
Glyt+NIS+AMS/ Glyt+NIS+AMS	6.4+0.25%+12/ 6.4+0.25%+12	98	87	94	0	99	98	99	99	99
Glufosinate[b]+AMS	7+48	81	81	75	89	95	81	57	35	67
Thif&trib[c]+clet[d]+NIS	0.45+1.4+0.25%	95	95	87	98	99	94	98	97	94
Thif&trib+nico+NIS	0.45+0.6+0.25%	97	96	91	99	99	92	96	98	88
Imazamox+NIS+UAN	0.5+0.25%+32	90	86	88	96	97	81	91	71	90
Thif-sg[e]+NIS	0.45+0.25%	94	94	40	89	98	96	94	98	0
Thif&trib+NIS	0.45+0.25%	94	93	42	98	99	95	97	96	0
Thif-sg+trib-sg+NIS	0.34+0.11+0.25%	93	92	40	90	98	97	98	99	0
Thif-sg+trib-sg+NIS	0.36+0.09+0.25%	92	93	40	97	99	94	99	98	0
Quin+thif&trib+NIS	0.71+0.22+0.25%	93	92	40	97	99	92	95	97	0
Quin+thif&trib+NIS	0.71+0.45+0.25%	90	91	45	97	98	90	93	92	0
Quin+thif&trib+clet+NIS	1.76+0.45+1.4+0.25%	91	90	79	97	99	94	94	96	94
Thif-sg+trib-sg+clet+NIS	0.36+0.09+1.4+0.25%	91	91	76	97	99	94	95	96	94
Thif-sg+trib-sg+nico+NIS	0.36+0.09+0.6+0.25%	91	90	85	98	99	96	96	95	90
Primisulfuron+NIS	0.75+0.25%	91	50	77	97	99	62	89	69	81
Untreated		0	0	0	0	0	0	0	0	0
C.V.		2	4	6	2	1	5	3	4	6
LSD 5%		2	5	6	2	1	6	4	5	5

[a] Glyphosate as Buccaneer from West Central.
[b] Glufosinate as Ignite from Bayer CropSciences.
[c] Thifensulfuron&tribenuron formulation provided by study cooperator.
[d] Clethodim as Select Max from Valent.
[e] Soluble granule (-sg) formulations provided by DuPont.

Chickpea tolerance to Sharpen applied PRE. Jenks, Willoughby, and Hoefing. 'B90' chickpea was seeded May 15 at 140 lb/A into 7.5-inch rows into wheat stubble. Glyphosate was applied preplant over the entire study area on May 14. Herbicides treatments were applied preemergence (PRE) on May 18. Individual plots were 10 x 30 ft and replicated three times.

The objective of the study was to evaluate chickpea response to high rates of Sharpen. There was no visible injury with Sharpen at 50 or 75 g, while 100 g caused about 8% crop injury. Sharpen & Pursuit caused slightly more injury with 15% about 5 WAT. There were no treatment differences in chickpea yield; however, there was a slight trend for higher yield as rate increased. Since the study was not maintained weed free, the slight yield increase may be due do better weed control with higher rates.

Table. Chickpea tolerance to Sharpen applied PRE (0918).

		Chickpea					
Treatment[a]	Rate/ha	Jun 12	Jun 24	Jul 01	Jul 16	Yield	Test wt.
		--------------------% injury--------------------				bu/A	lb/bu
Untreated		0	0	0	0	1244	60.1
Sharpen	50 g	0	0	0	0	1239	60.2
Sharpen	75 g	0	0	0	0	1557	60.3
Sharpen	100 g	0	3	8	8	1815	60.9
Sharpen & Pursuit	143 g	0	15	9	12	1862	61.1
LSD (0.05)		NS	4.9	NS[b]	6.6	NS[b]	NS
CV		387	70	137	89	18	1

[a] *Sharpen at 50 g/ha is equivalent to 2 fl oz/A*

[b] *Significant at α=0.10.*

Chickpea tolerance to experimental herbicides. Jenks, Willoughby, and Hoefing. 'B90' chickpea was seeded May 15 at 140 lb/A into 7.5-inch rows into wheat stubble. Glyphosate was applied preplant over the entire study area on May 14. Herbicides treatments were applied preemergence (PRE) on May 18. Individual plots were 10 x 30 ft and replicated three times.

The objective of the study was to evaluate chickpea response to experimental herbicides applied PRE. As of December 2009, Express, KIH-485, and Valor are not labeled for PRE use in chickpea. At the July 25 evaluation, all treatments except Express + Spartan and Valor (2 oz) provided ≥ 80% control of redroot pigweed. Treatments including Spartan or Sharpen provided ≥ 89% control of lambsquarters, while KIH-485 and Valor provided poor to fair lambsquarters control. Only treatments containing Spartan provided excellent kochia control. Treatment containing Spartan, Sharpen (4 oz), and Valor (3 oz) provided good to excellent wild buckwheat control. No visible chickpea injury was observed in any treatment.

Table. Chickpea tolerance to experimental herbicides (0911).

		Rrpw[b]			Colq[b]			Kocz[b]			Wibw[b]	Chickpea[c]	
Treatment[a]	Rate	Jun 30	Jul 11	Jul 25	Jun 30	Jul 11	Jul 25	Jun 30	Jul 11	Jul 25	Jun 30	Yield	Test wt.
		% control										lb/A	lb/bu
Untreated		0	0	0	0	0	0	0	0	0	0	1069	60.1
Express + Spartan	0.25 oz + 4.5 fl oz	80	76	77	94	95	94	93	90	90	89	1809	62.1
Sharpen + Spartan	1 fl oz + 4.5 fl oz	84	81	80	98	98	97	99	95	96	95	1908	61.5
Sharpen	4 fl oz	92	88	85	92	89	89	85	77	77	97	2108	61.7
KIH-485	0.15 lb ai	89	89	88	40	40	43	53	50	52	43	1732	61.1
KIH-485	0.3 lb ai	91	91	94	47	62	63	67	63	63	47	1849	59.9
Valor	2 oz	71	78	78	69	62	67	59	62	65	65	1703	61.3
Valor	3 oz	86	85	86	77	74	76	79	72	75	83	2032	61.8
Spartan	4.5 fl oz	84	86	87	95	95	95	95	96	93	95	1967	61.4
Handweeded[d]		100	100	99	100	100	99	100	100	97	100	1855	60.8
LSD (0.05)		10.3	10.9	10.5	15.3	12.4	11.5	12.5	13	10.5	9.6	480	NS
CV		8	8	8	12	10	9	10	11	9	8	16	2

[a] *All treatments applied PRE*

[b] *Rrpw =Redroot pigweed; Colq =Common lambsquarters; Kocz =Kochia; Wibw =Wild buckwheat*

[c] *No visual chickpea injury was observed in any treatment*

[d] *Prowl H20 (3 pt) was applied PRE to aid handweeding*

Chickpea desiccation with Sharpen, Valor, and Paraquat. Jenks, Willoughby, and Hoefing. 'B90' chickpea was seeded May 15 at 140 lb/A into 7.5-inch rows into wheat stubble. Desiccation treatments were applied pre-harvest on September 2. There were essentially no weeds present in the study. Individual plots were 10 x 30 ft and replicated four times.

At 1 week after treatment (WAT), Gramoxone provided slightly faster desiccation (99%) than other treatments (88-94%). Sharpen + Glyphosate was slightly more effective than Sharpen alone or Valor. At 2 WAT, desiccation was still slightly better with Gramoxone compared to other treatments. There were no significant differences in chickpea yield or test weight between treatments. Note: As of December 2009, Sharpen and Valor are not labeled for use as desiccants in chickpea.

Table. Chickpea desiccation with Sharpen, Valor, and Paraquat (0909).

		Chickpea			
Treatment[a]	Rate	1 WAT	2 WAT	Yield	Test wt.
		------% desiccation------		lb/A	bu/A
Untreated		83	86	2238	59.9
Sharpen + MSO + AMS	2 fl oz + 1% + 2%	92	93	2126	59.6
Sharpen + Glyphosate + MSO + AMS	1 fl oz + 1 qt + 1% + 2%	94	97	2138	60.3
Valor + MSO	2 oz + 1%	88	92	2209	60.2
Gramoxone Inteon + NIS	1.5 pt + 0.25%	99	99	2114	60.2
LSD (0.05)		4.9	3.2	NS	NS
CV		3	2	9	1

[a] *All treatments applied pre-harvest and evaluated 1 and 2 weeks after treatment (WAT)*

Crop response and weed control with preplant Valor in pinto bean, Carrington, 2009.

(Greg Endres)

The field experiment was conducted in cooperation with Valent at the NDSU Carrington Research Extension Center to examine pinto bean tolerance and weed control with preplant (PP) Valor. The experimental design was a randomized complete block with three replicates. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 20 gal/A at 35 psi through 8002 flat fan nozzles to the center 6.7 ft of 10 by 30 ft plots. Early PP treatments were applied on May 5 with 56 F and 69% RH to 2- to 3-leaf volunteer barley, 6-inch tall quackgrass, 1- to 5-inch tall sheperdspurse, and 0.5-inch wide kochia. The second PP treatments were applied on May 16 with 55 F and 28% RH to 0.5- to 1.5-inch wide kochia. 'Lariat' was direct-planted into barley stubble on May 22 in 30-inch rows and replanted on June 12 due to a variable and low-density initial stand. The trial was over-sprayed with Rezult at 3.2 pt/A plus Reflex at 12 fl oz/A plus MSO at 20 fl oz/A on July 2, except the untreated check.

Weed control generally was excellent (88-99%) among herbicide treatments 24 d after application (Table). Kochia control generally was similar among herbicide treatments and ranged from 69 to 76% when evaluated on June 30. A visual evaluation of the initially-established dry beans on May 12 (data not shown) indicated no distortion of leaf foliage. Also, shoot lesions or discoloration was similar among treatments when visually evaluated on June 15. An evaluation was made on June 30 of the replanted stand with no distortion of leaf foliage noted (data not shown). Leaf malformation was noted during evaluations in July and August, but appeared to be caused by the POST herbicide tank mixture applied on July 2.

Table.

		Weed control[1]						Crop response[2]		
Herbicide		5/29					6/30	6/15	7/21	8/24
								Shoot	Leaf	
Treatment[3]	Product/A	Voba	Qugr	Shpu	KOCZ	Colq	KOCZ	lesions	malformation	
		%						%		0-9
untreated check	x	0	0	0	0	0	0	7	0	0
May 5:										
Valor SX + Roundup PowerMax	2 oz + 22 fl oz	89	93	99	94	98	69	27	80	1
Valor SX + Roundup PowerMax	3 oz + 22 fl oz	88	97	98	97	99	75	7	80	1
May 16:										
Valor SX + Roundup PowerMax	2 oz + 22 fl oz	98	97	98	95	99	74	20	70	2
Valor SX + Roundup PowerMax	3 oz + 22 fl oz	98	95	96	93	99	76	20	70	1
Prowl H2O + Roundup PowerMax	40 + 22 fl oz	95	98	95	91	99	72	13	77	2
C.V. (%)		5.3	1.6	3.4	3.0	1.2	6.2	132.1	21.5	42.4
LSD (0.05)		7	2	5	4	2	7	NS	25	1

[1]Voba=volunteer barley; Qugr=quackgrass; Shpu=sheperdspurse:KOCZ=kochia; Colq=common lambsquarters.

[2]Shoot lesions=incidence among five plants/plot; Leaf malformation: %=incidence among 10 plants/plot and 0-9=visual evaluation of plot (0=no injury and 9=all plants with injury).

[3]All treatments include AMS (Cornbelt Amstik) at 64 fl oz/A.

Eptam and Permit in dry beans. Zollinger, Richard K., Jerry L. Ries, and Angela J. Kazmierczak. An experiment was conducted near Thompson, ND to evaluate weed control in dry bean with various tank-mix treatments and applications. June 2, 2009, PPI treatments were applied and double incorporated with a field cultivator to a 2 to 3 inch depth. Two rows of 'Ensign' navy bean and 'Lariat' pinto bean were planted in each plot followed by the application of PRE treatments. PPI and PRE treatments were applied at 10:20 and 10:50 am, respectively, with 55 F air, 52 F soil at a four inch depth, 39% relative humidity, 20% clouds, 7 to 10 mph NW wind, dry soil surface, moist subsoil, and no dew present. POST treatments were applied on July 7 at 11:35 am, with 80 F air, 78 F soil surface, 48% relative humidity, 98% clouds, 1 to 3 mph N wind, dry soil surface, moist subsoil, and no dew present. Weed species present at the time of POST applications were: 1 to 4 inch (2/yd^2) common lambsquarters and 1 to 3 inch (1 to 3/yd^2) redroot pigweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo nozzles for the PPI and PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

All PRE and PPI treatments gave greater than 96% control of common lambsquarters 21 DAT (data not shown). Injury was slight stunting and chlorosis. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Eptam and Permit in dry beans (Zollinger, Ries, and Kazmierczak).

Treatment	Rate	35 DAT - PPI/PRE				14 DAT - POST				28 DAT - POST				Yield	
		Navy	Pinto	Colq	Rrpw	Navy	Pinto	Colq	Rrpw	Navy	Pinto	Colq	Rrpw	Navy	Pinto
	(product/A)	- % injury -		- % control -		- % injury -		- % control -		- % injury -		- % control -		- - lb/A - -	
PPI															
Eptam	4pt	0	4	88	93	0	1	88	96	0	0	65	67	1219	886
Eptam+Sonalan	4pt+1.25pt	0	0	98	95	0	0	98	95	0	0	94	88	1539	1453
Eptam+Sonalan	3.5pt+2pt	0	4	97	97	0	1	97	97	0	0	94	93	1944	1443
Eptam+Prowl H_2O	3.5pt+2pt	0	1	94	97	0	1	94	97	0	1	88	83	1337	1257
Eptam+Sonalan+Permit	3.5pt+2pt+0.67pz	0	0	97	98	0	0	97	98	0	0	91	93	1577	1438
Eptam+Permit	4pt+0.67oz	0	1	97	97	0	1	97	97	2	3	87	89	1514	1523
Sonalan+Permit	3pt+0.67oz	0	2	99	99	0	2	99	99	0	1	97	94	1976	1403
PPI/PRE															
Eptam/Permit	4pt/0.67oz	0	0	99	96	0	0	99	96	0	0	96	94	1807	1574
Prowl H_2O+Permit	3.33pt/0.67oz	0	1	96	98	0	1	96	98	0	1	91	96	1698	1295
PPI/EPOST															
Eptam+Sonalan/Permit+R-11+ 28% N	3.5pt+2pt/0.67oz+0.25% v/v+ 1% v/v	0	1	97	97	0	1	96	95	2	2	93	92	1613	1383
PRE/EPOST															
Permit/Reflex+Scoil	0.67oz/0.75pt+1.5pt	0	1	99	99	0	1	93	92	2	2	88	89	1824	1414
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	667	661
LSD (0.05)		NS	2	8	4	NS	2	8	6	2	3	9	8	577	339

Pyroxasulfone tolerance of Navy and Pinto Bean. Hunt, Ryan L. and Richard K. Zollinger. Experiments were setup in both 2008 and 2009 near Prosper, Hatton, and Thompson, ND. Beans were planted in 2008 on May 22, June 2, and May 23 in Prosper, Hatton, and Thompson respectively. PRE applications were made on May 22, June 4, and May 23 at Prosper, Hatton, and Thompson. Beans were planted in 2009 on May 30, June 6, and June 10. Prosper, Hatton, Thompson. PRE applications were made on June 1, June 10, and June 10 in Prosper, Hatton, and Thompson. No weeds were present at time of PRE applications. Cultivation and standard POST herbicides were used to maintain plots weed free.

Navy Bean. In 2008, yield at Hatton and Thompson significantly decreased as rate of pyroxasulfone increased. Prosper was unable to be harvested due to weather conditions. In 2009, yield at Prosper and Thompson significantly decreased as pyroxasulfone rate increased, but did not change at Hatton.

Pinto Bean. In 2008, yield at Hatton significantly decreased as pyroxasulfone rate increased; however, Thompson did not significantly change and Prosper was unable to be harvested due to weather conditions. In 2009, yields were not significantly different at all locations.

Injury values for both navy and pinto beans were higher in 2008 compared to 2009. The increased injury in 2008 may be due to an activating rainfall occurring in 2008 while the beans were in the cracking stage, in 2009 an activating rainfall did not occur until the beans were well established.

(Dept. of Plant Sciences, North Dakota State University, Fargo).

2008 Navy Bean Tolerance to Pyroxasulfone (Hunt and Zollinger)

Treatment	Rate	Prosper				Hatton				Thompson			
		14 DAE	28 DAE	56 DAE	yield	14 DAE	28 DAE	56 DAE	yield	14 DAE	28 DAE	56 DAE	yield
	(g/ha)	% injury			(kg/ha)	% injury			(kg/ha)	% injury			(kg/ha)
Pyroxasulfone	84	18c	6c	2c	-	0b	0d	0b	1920a	1c	0c	0c	1297b
	125	30c	17c	12c	-	9b	10c	1b	1636ab	1c	1c	1bc	1486ab
	166	71b	40b	26b	-	21a	18b	5b	1694ab	10b	7b	9b	1243b
	332	96a	93a	99a	-	28a	30a	19a	1272b	46a	23a	21a	927c
Dimethanamid-p	1100	1d	0c	0c	-	0b	0d	0b	2108a	0c	0c	0c	1594a
LSD		12.8	20	11.9	-	11.9	7.1	8.4	566.1	8.9	4.2	8	283.6

2008 Pinto Bean Tolerance to Pyroxasulfone (Hunt and Zollinger)

Treatment	Rate	Prosper				Hatton				Thompson			
		14 DAE	28 DAE	56 DAE	yield	14 DAE	28 DAE	56 DAE	yield	14 DAE	28 DAE	56 DAE	yield
	(g/ha)		% injury		(kg/ha)		% injury		(kg/ha)		% injury		(kg/ha)
Pyroxasulfone	84	1c	2c	0b	-	0b	0b	0b	2277ab	0b	0b	0b	1411a
	125	11b	9c	2b	-	0b	0b	0b	1862b	0b	0b	0b	1540a
	166	18b	23b	14b	-	0b	2b	3b	2051ab	0b	0b	0b	1740a
	332	35a	75a	39a	-	12a	9a	11a	1819b	9a	8a	4a	1369a
Dimethanamid-p	1100	0c	0c	0b	-	0b	0b	0b	2415a	0b	0b	0b	1560a
LSD		8.2	11.3	20.6	-	4.1	2.8	3.4	485.8	2.1	3.8	3.9	439.1

2009 Navy Bean Tolerance to Pyroxasulfone (Hunt and Zollinger)

		Prosper				Hatton				Thompson			
	DAE	14	28	56		14	28	56		14	28	56	
Treatment	Rate (g/ha)	% injury			yield (kg/ha)	% injury			yield (kg/ha)	% injury			yield (kg/ha)
Pyroxasulfone	84	0b	0b	0a	3306a	0c	0b	0b	2149a	0b	0b	0b	2401ab
	125	0b	0b	0a	3338a	2c	0b	0b	2198a	0b	2b	0b	2242ab
	166	0b	0b	0a	3159a	10b	1b	0b	2207a	2b	3b	1b	2415ab
	332	20a	8a	1a	3035b	33a	12a	0b	2123a	14a	38a	19a	2112b
Dimethanamid-p	1100	0b	0b	0a	3247a	0c	0b	9a	2310a	0b	0b	0b	2539a
LSD		2.8	1.6	1.7	251.1	4.5	2.5	3.3	386.6	3.7	8.7	3.9	402

2009 Pinto Bean Tolerance to Pyroxasulfone (Hunt and Zollinger)

		Prosper				Hatton				Thompson			
	DAE	14	28	56		14	28	56		14	28	56	
Treatment	Rate (g/ha)	% injury			yield (kg/ha)	% injury			yield (kg/ha)	% injury			yield (kg/ha)
Pyroxasulfone	84	0a	0a	0a	3271a	0b	0b	0b	2379a	0b	0c	0b	2352a
	125	0a	0a	0a	3377a	0b	0b	0b	2392a	0b	0c	0b	2385a
	166	0a	0a	0a	3444a	3b	1b	1ab	2443a	1ab	5b	0b	2548a
	332	0a	0a	0a	3354a	21a	11a	6a	2531a	3a	14a	4a	2340a
Dimethanamid-p	1100	0a	0a	0a	3538a	0b	0b	0b	2537a	0b	0b	0b	2399a
LSD		0	0	0	342.1	4	3.3	5.4	601.5	2.1	4	2.1	227.5

Gowan Dry Edible Bean Desiccation. Zollinger, Richard K., Jerry L. Ries, and Angela J. Kazmierczak. An experiment was conducted near Thompson, ND, to evaluate Gowan's 'Vida' desiccant. Hyland 'T9905' navy bean was planted on June 6, 2009, and maintained by the cooperator throughout the growing season. Desiccation treatments were applied on September 4 at 9:30 am with 62 F air, 76 F soil surface, 93% relative humidity, 15% cloud cover, 4 to 6 mph S wind, dry soil surface and moist subsoil. Applications were applied earlier than normal do to high levels of white mold and late blight that was occurring in the field. Applications were made at 25 to 75% leaf drop; 0 to 20% vine desiccation; 30 to 50% green pods; 50 to 70% yellow pods; and 0% dry/leather pods. White mold was present on the entire plant including on the seed. The higher the percentages at application were do to plants that were seriously infected by white mold. Crop destruct was done after the last ratings were taken. Treatments were applied to the entire 6.7 by 30 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for all applications. The experiment had a randomized complete block design with six replicates per treatment.

Vida, active ingredient pyraflufen, is a new desiccant that we used in dry bean desiccation.The higher rate of Vida increased the speed of desiccation than the lower rate. At 14 DAT Vida had similar control ratings to Valor. All Vida treatments, the pH was lowered to 5.0 to 5.1 with Tri-Fol.
(Dept of Plant Sciences, North Dakota State University, Fargo).

Table 1. Gowan Dry Edible Bean Desiccation (Zollinger, Ries, and Kazmierczak).

		7 DAT					10 DAT					14 DAT				
Treatment	Rate	leaf[1]	vine[2]	green[3]	yellow[4]	brown[5]	leaf	vine	green	yellow	brown	leaf	vine	green	yellow	brown
	(product/A)	-------- % control --------					-------- % control --------					-------- % control --------				
Vida+Scoil	4.125fl oz+1% v/v	83	23	4	84	12	93	23	4	66	30	97	28	1	37	62
Vida+Scoil	2.75fl oz+1% v/v	77	17	7	78	17	86	22	3	63	30	92	37	3	49	48
Vida+Rounup WeatherMax+Scoil	2.75fl oz+22fl oz+1% v/v	82	13	10	80	10	90	22	7	64	28	96	33	4	54	45
Valor+Scoil	1.5oz+1% v/v	88	33	5	83	12	95	32	4	56	41	99	47	0	33	67
Untreated		45	6	22	73	5	62	7	13	78	9	68	11	17	52	35
LSD (0.05)		5	4	4	6	4	4	5	4	4	5	3	8	4	8	5

[1]Leaf = % leaf desiccation and leaf drop.
[2]Vine = % vine desiccation.
[3]Green = % green pods.
[4]Yellow = % yellow pods.
[5]Brown = % dry pods.

Sharpen as a desiccant in dry edible beans. Zollinger, Richard K., Jerry L. Ries, and Angela. J. Kazmierczak. Five dry bean studies were conducted in the fall of 2009, two near Thompson, ND, and three near Portland, ND. At Thompson, Study 1, Sharpen was used at various application rates to evaluate dry bean desiccation. At Thompson, Study 2, Sharpen was applied at one rate with varying adjuvants and application volumes to evaluate dry bean desiccation. At Portland, Study 3, 4, and 5, Sharpen was applied at one rate to 3 dry bean types to screen for Sharpen residue in the harvested seed.

Study 1 and 2: Hyland 'T9905' navy bean was planted on June 6, 2009, and maintained by the cooperator throughout the growing season. Study 1, desiccation treatments were applied on September 4 at 9:40 am with 77, 62 F air, 76 F soil surface, 93% relative humidity, 15% cloud cover, 4 to 6 mph S wind, dry soil surface and moist subsoil. Study 2, desiccation treatments were applied at 10:00 am with the same environmental data.

Studies 1 and 2, the applications were applied earlier than normal do to high levels of white mold and late blight that was occurring in the field. Applications were made at 25 to 75% leaf drop; 0 to 20% vine desiccation; 30 to 50% green pods; 50 to 70% yellow pods; and 0% dry/leather pods. White mold was present on the entire plant including on the seed. The higher the percentages at application were do to plants that were seriously infected by white mold. Crop destruct was done after the last ratings were taken for both studies.

Study 3, 4, 5: At Portland, 'Ensign' navy bean, 'Montcalm' dark red kidney, and 'T-39' black bean were planted on June 10, 2009. The bean types were maintenance sprayed and hand-weeded during the growing season. There was little to no disease pressure at the Portland location. Applications were made at greater than 80% leaf drop for all bean types. Navy bean applications were applied on Sept 24 at 9:50 am with 73 air, 74 F soil surface, 86% relative humidity, 33% cloud cover, 0 mph wind, dry soil surface and moist subsoil. Navy bean was at 85 to 92 % leaf drop; 45 to 60% vine desiccation; 2 to 5% green pods; 10% yellow pods; and 85% dry/leather pods. Black and Dark Red Kidney bean applications were applied on Sept 17 at 10:30 am with 75 air, 78 F soil surface, 44% relative humidity, 10% cloud cover, 1 to 3 mph SW wind, dry soil surface and moist subsoil. Black bean was at 75 to 99% leaf drop; 35 to 85% vine desiccation; 5 to 10% green pods; 5 to 20% yellow (purple) pods; and 75 to 85% dry/leather pods. Dark Red Kidney bean was at 65 to 85% leaf drop; 25 to 50% vine desiccation; 10% green pods; 10% yellow pods; and 80% dry/leather pods. Seeds from each bean type were collected at 14 DAT from the top, middle, and bottom of each plant. Each plant section of seeds collected were bagged by their plant part and sent for residue samples. Crop destruct was done after the last ratings and seed was harvested.

Treatments for all studies, at all locations, were applied to the entire 6.7 by 30 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles for all applications. The experiment had a randomized complete block design with six replicates per treatment.

Sharpen and Valor are PPO inhibitor that work very well at low use rates as a dry bean desiccant. At Thompson, Study 1, Sharpen at three use rates, there are little rate response differences, 0.72 to 2 fl oz. Valor is also an herbicide that works very well as a desiccant that is generally equal to that of Sharpen. Aim also worked well, but takes longer to get adequate desiccation. Study 2 at Thompson, 5 gpa generally desiccated as well as 10 gpa.

At Portland, residue seed samples were not available at the time of this report. Applications were made at normal desiccation timing so residue samples could be harvested, so there is little difference in the ratings of the residue studies. Treatments gave excellent desiccation.
(Dept of Plant Sciences, North Dakota State University, Fargo).

Table 1. Study 1, Rate response to Sharpen, Thompson (Zollinger, Ries, and Kazmierczak).

Treatment[1]	Rate	7 DAT					10 DAT					14 DAT				
		leaf[2]	vine[3]	green[4]	yellow[5]	brown[6]	leaf	vine	green	yellow	brown	leaf	vine	green	yellow	brown
	(product/A)	-------- % control --------					-------- % control --------					-------- % control --------				
Sharpen+Scoil+AMS	0.72fl oz+1% v/v+17lb/100gal	90	47	5	22	73	94	48	2	51	47	98	72	0	10	90
Sharpen+Scoil+AMS	1fl oz+1% v/v+17lb/100gal	92	83	5	20	75	96	65	0	42	58	99	90	0	6	94
Sharpen+Scoil+AMS	2fl oz+1% v/v+17lb/100gal	94	88	8	20	75	97	78	0	25	42	99	98	0	2	98
RUPM+Scoil+AMS	22fl oz+1% v/v+17lb/100gal	78	48	48	48	33	83	15	13	52	35	87	47	2	36	62
Sharpen+RUPM+Scoil+AMS	0.72fl oz22fl oz+1% v/v+17lb/100gal	91	45	6	23	72	95	47	0	37	63	99	91	0	14	86
Valor+Scoil	1.5oz+1% v/v	91	48	6	25	68	96	73	1	31	68	99	93	0	9	91
Aim+Scoil+AMS	2.63fl oz+1% v/v+17lb/100gal	82	38	11	30	58	87	43	5	33	65	98	72	2	16	82
Untreated		48	4	22	68	12	52	6	18	73	11	60	8	10	57	32
LSD (0.05)		3	4	3	6	4	3	4	3	4	12	2	4	1	5	5

[1]RUPM = Roundup PowerMax.
[2]Leaf = % leaf desiccation and leaf drop.
[3]Vine = % vine desiccation.
[4]Green = % green pods.
[5]Yellow = % yellow pods.
[6]Brown = % dry pods.

Table 2. Study 2, Volume and adjuvant response to Sharpen, Thompson (Zollinger, Ries, and Kazmierczak).

Treatment[1]	Rate	7 DAT					10 DAT					14 DAT				
		leaf[2]	vine[3]	green[4]	yellow[5]	brown[6]	leaf	vine	green	yellow	brown	leaf	vine	green	yellow	brown
	(product/A)	-------- % control --------					-------- % control --------					-------- % control --------				
10 GPA																
Sharpen+R-11+AMS	1fl oz+0.25% v/v+17lb/100gal	91	42	5	15	80	93	38	1	49	40	99	65	0	22	73
Sharpen+Herbimax+AMS	1fl oz+1% v/v+17lb/100gal	92	45	4	16	80	96	48	1	43	57	99	83	0	15	87
Sharpen+Scoil+AMS	1fl oz+1% v/v+17lb/100gal	94	47	3	19	78	98	73	0	27	73	99	93	0	10	92
5 GPA																
Sharpen+Scoil+AMS	1fl oz+1% v/v+17lb/100gal	90	72	4	18	75	95	67	1	33	67	99	83	0	15	87
Untreated		52	4	18	77	5	62	6	13	73	13	68	11	11	63	27
LSD (0.05)		4	5	3	4	3	3	6	3	6	11	2	3	1	4	5

[1]RUPM = Roundup PowerMax.
[2]Leaf = % leaf desiccation and leaf drop.
[3]Vine = % vine desiccation.
[4]Green = % green pods.
[5]Yellow = % yellow pods.
[6]Brown = % dry pods.

Table 3. Study 3, Black Bean Desiccation, Portland (Zollinger, Ries, and Kazmierczak).

		5 DAT					10 DAT					14 DAT				
Treatment	Rate	leaf[1]	vine[2]	green[3]	yellow[4]	brown[5]	leaf	vine	green	yellow	brown	leaf	vine	green	yellow	brown
	(product/A)	-------- % control --------					-------- % control --------					-------- % control --------				
Sharpen+Scoil+AMS	1fl oz+1% v/v+17lb/100gal	98	96	0	0	99	99	99	0	0	99	99	99	0	0	99
Untreated		93	93	0	3	97	95	95	0	0	99	99	95	0	0	99
LSD (0.05)		8	1	NS	1	1	1	1	NS	NS	NS	NS	1	NS	NS	NS

[1]Leaf = % leaf desiccation and leaf drop.
[2]Vine = % vine desiccation.
[3]Green = % green pods.
[4]Yellow = % yellow pods.
[5]Brown = % dry pods.

Table 4. Study 4, Dark Red Kidney Bean Desiccation, Portland (Zollinger, Ries, and Kazmierczak).

		5 DAT					10 DAT					14 DAT				
Treatment	Rate	leaf[1]	vine[2]	green[3]	yellow[4]	brown[5]	leaf	vine	green	yellow	brown	leaf	vine	green	yellow	brown
	(product/A)	-------- % control --------					-------- % control --------					-------- % control --------				
Sharpen+Scoil+AMS	1fl oz+1% v/v+17lb/100gal	97	48	0	0	99	99	62	0	0	99	99	82	0	0	99
Untreated		85	28	1	1	98	89	37	0	0	99	92	40	0	0	99
LSD (0.05)		6	9	1	3	3	7	9	NS	NS	NS	6	13	NS	NS	NS

[1]Leaf = % leaf desiccation and leaf drop.
[2]Vine = % vine desiccation.
[3]Green = % green pods.
[4]Yellow = % yellow pods.
[5]Brown = % dry pods.

Table 5. Study 5, Navy Bean Desiccation, Portland (Zollinger, Ries, and Kazmierczak).

		5 DAT					10 DAT					14 DAT				
Treatment	Rate	leaf[1]	vine[2]	green[3]	yellow[4]	brown[5]	leaf	vine	green	yellow	brown	leaf	vine	green	yellow	brown
	(product/A)	-------- % control --------					-------- % control --------					-------- % control --------				
Sharpen+Scoil+AMS	1fl oz+1% v/v+17lb/100gal	99	99	0	0	99	99	99	0	0	99	99	99	0	0	99
Untreated		92	78	1	16	83	97	93	0	5	95	99	99	0	0	99
LSD (0.05)		7	7	4	3	7	4	7	NS	NS	NS	NS	NS	NS	NS	NS

[1]Leaf = % leaf desiccation and leaf drop.
[2]Vine = % vine desiccation.
[3]Green = % green pods.
[4]Yellow = % yellow pods.
[5]Brown = % dry pods.

Dry pea tolerance to Sharpen applied preemergence. Jenks, Willoughby, and Hoefing. 'Majoret' dry pea was seeded May 12 at 140 lb/A into 7.5-inch rows into wheat stubble. Herbicides treatments were applied preemergence (PRE) on May 12. Individual plots were 10 x 30 ft and replicated three times. There were very few weeds present at application time or during the growing season.

The objective of the study was to determine dry pea sensitivity to higher rates of Sharpen. There was essentially no visible injury with any of the treatments. However, there was a downward trend in yield as Sharpen rate increased. We observed a similar trend in 2008 where we actually saw about 15-20% growth reduction and about 100 lb/A lower dry pea yield with the high rate of Sharpen. Note that the normal use rate in dry pea will be 25 g/ha, which is equivalent to 1 fl oz/A.

Table. Dry pea tolerance to Sharpen applied PRE (0938).

		Dry pea					
Treatment[a]	Rate/ha	Jun 04	Jul 01	Jul 08	Jul 22	Yield	Test wt.
		------% injury------				lb/A	lb/bu
Untreated		0	0	0	0	2515	66.0
Sharpen[b]	50 g	0	0	0	0	3027	66.0
Sharpen	75 g	0	0	0	0	2805	66.2
Sharpen	100 g	1	0	0	0	2684	65.8
Sharpen & Pursuit	143 g	0	0	0	0	3501	66.6
LSD (0.05)		NS	NS	NS	NS	485	NS
CV		164	0	0	0	9	1

[a] *All treatments were applied PRE.*

[b] *Sharpen at 50 g/ha is equivalent to 2 fl oz/A*

Dry pea tolerance and weed control with Sharpen. Jenks, Willoughby, and Hoefing. 'Majoret' dry pea was seeded May 12 at 140 lb/A into 7.5-inch rows into wheat stubble. Herbicides treatments were applied preemergence (PRE) on May 12. Individual plots were 10 x 30 ft and replicated three times. There were very few weeds present at application time. Wild buckwheat was the only broadleaf weed present in significant densities during the season. All treatments received two applications of Select Max for grass control.

The objective of the study was to evaluate residual weed control with Sharpen + Glyphosate compared to Glyphosate alone as well as Aim + Glyphosate. None of the treatments caused visible crop injury. By 16 days after treatment (DAT), wild buckwheat control dropped below 90% for Glyphosate alone and Aim + Glyphosate. By 4 weeks after treatment (WAT), wild buckwheat control dropped below 60% for Glyphosate alone and Aim + Glyphosate, whereas control with treatments containing Sharpen still provided greater than 90% control. By 6 WAT, Sharpen at 25 g provided 83-87% wild buckwheat control compared to 95% with 50 g and 93% where 25 g was tank mixed with Prowl H2O. This study showed that Sharpen can have a residual benefit with adequate soil moisture and rainfall. However, growers should not always expect this type of residual benefit.

Table. Dry pea tolerance and weed control with Sharpen (0939).

Treatment[a]	Rate/ha	Dry pea May 28	Dry pea Jun 13	Dry pea Jul 01	Wibw[b] May 23	Wibw May 28	Wibw Jun 13	Wibw Jul 01	Dry pea Yield	Dry pea TW
		--------% injury---------			------------- control---------------				lb/A	lb/bu
Untreated		0	0	0	0	0	0	0	2742	65.2
Glyphosate + NIS	840 g + 0.25%	0	0	0	93	80	55	48	3335	66.4
Sharpen + Glyphosate + MSO	25 g + 420 g + 1%	0	0	0	99	99	94	83	3510	65.6
Sharpen + Glyphosate + MSO	25 g + 840 g + 1%	0	0	0	99	98	91	87	3745	66.1
Sharpen + Glyphosate + MSO	50 g + 840 g + 1%	0	0	0	100	100	96	95	3923	66.0
Aim EW + Glyphosate + COC	8.33 g + 840 g + 1%	0	0	0	94	89	59	42	3510	65.3
Sharpen + Prowl H20 + Glyphosate + MSO	25 g + 798 g + 840 g + 1%	0	0	0	100	99	95	93	4106	66.4
LSD (0.05)		NS	NS	NS	2.9	6.3	14.4	14.6	478	NS
CV		0	0	0	2	4	12	13	8	1

[a] *All treatments were applied PRE; AMS (2%) was applied with each treatment; Sharpen at 25 g/ha is equivalent to 1 fl oz/A*

[b] *Wibw =Wild Buckwheat*

Dry pea tolerance to experimental herbicides. Jenks, Willoughby, and Hoefing. 'Majoret' dry pea was seeded May at 140 lb/A into 7.5-inch rows into wheat stubble. Herbicides treatments were applied preemergence (PRE) on May 12. Glyphosate and AMS (0.75 lb ae + 1%) were included with each treatment. Individual plots were 10 x 30 ft and replicated three times.

The objective of the study was to evaluate dry pea response to experimental herbicides applied PRE. As of December 2009, Express, KIH-485, and Valor are not labeled for PRE use in dry pea. Less than 10% crop injury was observed in all treatments 4 weeks after treatment (WAT) and no injury observed at 8 WAT. All treatments provided good to excellent wild buckwheat control except for KIH-485 and Valor (2 oz). Wild buckwheat density was generally low throughout the study area. Dry pea yield and test weight were similar across all herbicide treatments. Yield and test weight in the untreated check were significantly lower than all herbicide treatments.

Table. Dry pea tolerance to experimental herbicides (0917).

		Dry pea			Wibw[b]		Dry pea	
Treatment[a]	Rate	Jun 12	Jul 05	Jul 25	Jun 12	Jul 05	Yield	Test wt.
		-------% injury---------			--% control--		lb/A	lb/bu
Untreated		0	0	0	0	0	2099	62.5
Express + Spartan	0.25 oz + 4.5 fl oz	1	0	0	91	90	3014	65.2
Spartan + Sharpen + MSO + AMS	4.5 fl oz + 1 fl oz + 1% + 2.5%	2	0	0	97	97	2748	65.2
Sharpen + MSO + AMS	4 fl oz + 1% + 2.5%	9	0	0	97	98	2921	65.3
KIH-485	0.15 lb ai	2	0	0	47	43	2829	64.1
KIH-485	0.3 lb ai	4	0	0	70	67	3067	64.9
Valor	2 oz	2	0	0	89	74	2939	64.9
Valor	3 oz	8	0	0	95	83	2988	64.9
Spartan	4.5 fl oz	2	0	0	95	95	2802	65.0
Handweeded[c]		0	0	0	100	100	2725	65.1
LSD (0.05)		3.3	NS	NS	23.8	18.5	476	1.0
CV		2	0	0	14	11	10	1

[a] *All treatments applied PRE*

[b] *Wibw =Wild buckwheat*

[c] *Prowl H2O was applied PRE to aid handweeding*

Weed control in field pea, Williston 2009. Neil Riveland

'Majoret' green field pea was planted on April 21 into 2008 safflower stubble using a JD 750 notill drill with 7 inch row spacing at 150 lbs/a. All PE treatments were applied on May 7 to a dry soil surface with 55 F, 36% RH, 80% clear sky and wind at 1-4 mph from 234 degrees with topsoil at 54 F. The post emergence treatment was applied on June 5 to 5-6 inch peas and 1-3 inch Russian thistle (Ruth), prostrate pigweed (prpw) and nightshade less than 0.5 inches, and green foxtail (grft) 3-5 leaf stage with 41 degree F, 65% RH, 95% clear sky, wind at 2-3 mph from 230 degrees, dry plant and soil surfaces, with soil temperature at 50 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply all treatments. PE treatments were applied through 8002 flat fan nozzles delivering 20 gals/a at 40 psi. Post treatments were applied though 8001 flat fan nozzles delivering 10 gal/a at 40 psi. Plot size was 6.67 ft wide area the length of 10 by 30 ft plots. Glyphosate was applied to the whole plot area on April 20 to control emerged weeds. First rain received after PE applications was 0.04 inch on May 7. First rain event after post treatment was 0.34 inches on June 6. The experiment was a randomized complete block design with three replications. Plots were evaluated for crop injury and weed control June 14 and August 2. Russian thistle density was heavy at 4-5 plants/sq ft, green foxtail at 6-8 plts/sq ft and pigweed,common lambsquarters and eastern black nightshade at 1/2-2 plts/sq ft. Peas were machine harvested on August 3.

Treatment	Product Rate-Unit/a	Tpye	% Crop Injury 6/14	% Crop Injury 8/2	Test Weight lbs/bu	Grain Yield bus/a	Ruth 6/14	Ruth 8/2	Ebns 8/2	Grft 6/14	Grft 8/2	Prpw 8/2	Colq 8/2
							% Control						
Untreated			0	0	64.4	13.1	0	0	0	0	0	0	0
Express & Spartan	0.25&4.5 oz/a	Pre	4	3	64.5	19.7	97	98	99	82	78	98	99
Sharpen & Spartan	1 & 4.5 oz/a	Pre	4	3	64.6	19.6	98	99	99	80	80	99	98
Sharpen	4 fl oz/a	Pre	0	0	64.5	15.0	33	37	17	8	0	58	23
KIH-485	0.15 lb/a	Pre	2	0	64.6	15.8	17	17	3	0	65	0	0
KIH-485	0.30 lb/a	Pre	4	0	64.3	17.5	53	45	25	62	82	65	0
Valor	2 oz/a	Pre	8	3	64.7	17.4	92	91	83	60	48	86	77
Valor	3 oz/a	Pre	7	7	65.2	23.2	90	95	94	86	73	88	77
Spartan	4.5 fl oz/a	Pre	2	2	64.6	22.8	95	99	95	80	89	98	95
Prowl H2O 3 pt/a	3 pt/a	Pre	4	0	64.5	14.2	82	67	33	73	78	77	87
Metribuzen 6 oz/a	6 oz/a	Post	1	2	64.8	16.4	22	0	10	13	40	17	63
Raptor + Rezult	4 + 16 oz/a	Post	3	5	64.6	12.4	53	27	30	48	50	82	33
Pursuit	2 fl oz/a	Post	2	3	64.9	15.5	37	60	33	37	83	55	0
C.V. %			126	182	.4	17.8	23	29	49	29	34	23	31
LSD 5%			NS	NS	NS	5.1	23	28	40	24	34	24	26
LSD 1%			NS	NS	NS	7.0	30	38	54	32	46	33	36

Valor and Spartan gave good weed control with some tendency to have crop injury. Post emergence treatments did not control weeds adequately.

Preemergence weed control in field pea, Carrington, 2008 (Greg Endres). Weed control and field pea response to selected preemergence-applied (PRE) herbicide were evaluated in a randomized complete-block design with three replicates. The field experiment was conducted at the NDSU Carrington Research Extension Center on a conventional-tilled Heimdahl-Emrick loam soil with 2.8% organic matter and 6.8 pH. On April 30, inoculated 'Admiral' field pea was seeded in 7-inch rows at a rate of 300,000 pure live seeds/A. Herbicide treatments were applied with a CO_2 pressurized hand-held plot sprayer at 35 psi through 80015 flat-fan nozzles. PRE treatments were applied at 17 gpa on May 6 with 64 F, 33% RH, 100% cloudy sky, and 11 mph wind. Rainfall totaled 1.1 inches within 24 d following PRE application. POST treatments were applied on June 24 with 47 F, 78% RH, clear sky, and no wind to 3- to 4-inch tall field pea, 1- to 3-leaf foxtail (green and yellow) and 2-leaf redroot pigweed. POST treatments were applied on June 12 with 55 F, 75% RH, clear sky, and 14 mph wind to 5- to 6-inch tall field pea, 1- to 4-leaf yellow and green foxtail, 1- to 3-inch tall common lambsquarters, and 1- to 2-inch tall wild buckwheat.

No crop response with PRE treatments was observed when visually evaluated on June 10 (data not shown). Broadleaf weed control was poor to nonexistent with PRE treatments (Table). This was due to delayed rainfall (> 3 wk) to activate PRE herbicides. Foxtail generally was suppressed with POST grass herbicides. Common lambsquarters control ranged from 77 to 90% with POST broadleaf herbicides while wild buckwheat control was poor. Crop injury occurred with POST broadleaf plus grass herbicides.

Table.

	Herbicide		Weed control[1]					Crop response[2]	
			6/10		6/27				
Treatment[3]	Application timing[4]	Rate	colq	wibw	fota	colq	wibw	6/27	7/9
		product/A	%						
Untreated check	x	0	0	0	0	0	0	0	0
Lorox/Assure II + COC	PRE/POST	16 oz/8 fl oz + 1% v/v	40	0	68	0	0	0	0
Lorox/Assure II + COC	PRE/POST	32 oz/8 fl oz + 1% v/v	67	22	68	0	13	0	0
KIH485/Assure II + COC	PRE/POST	2.8 oz/8 fl oz + 1% v/v	27	0	68	0	0	0	0
KIH485/Assure II + COC	PRE/POST	5.6 oz/8 fl oz + 1% v/v	53	0	90	0	0	0	0
Sharpen/Assure II + COC	PRE/POST	2 fl oz/8 fl oz + 1% v/v	47	22	67	0	0	0	0
Sharpen/Assure II + COC	PRE/POST	4 fl oz/8 fl oz + 1% v/v	55	24	65	0	0	0	0
Sharpen + Pursuit	PRE	2 fl oz + 2 fl oz	53	x	67	0	0	0	0
Spartan + Pursuit	PRE	3 fl oz + 2 fl oz	66	22	75	0	0	0	0
Raptor + Basagran + COC + UAN	POST	4 fl oz + 16 fl oz + 1% v/v + 32 fl oz	x	x	76	90	40	15	2
Raptor + RezultB + RezultG + COC + UAN	POST	2 fl oz + 12.8 fl oz + 12.8 + 1% v/v + 32 fl oz	x	x	70	88	53	18	6
RezultB + RezultG + COC + UAN	POST	25.6 fl oz + 25.6 fl oz + 1% v/v + 32 fl oz	x	x	66	77	27	15	8
C.V. (%)			26.0	120.1	6.7	18.2	97.2	37.2	132.0
LSD (0.05)			20	NS	7	7	18	3	3

[1]Colq=common lambsquarters; wibw=wild buckwheat; fota=yellow and green foxtail.
[2]Crop response=plant height reduction.
[3]COC=Destiny (Winfield); UAN=urea ammonium nitrate.
[4]PRE=May 6; POST=June12.

2009 Rate and Timing of Assure II on Tough Grassy Weeds in Field Pea

Eric Eriksmoen, Hettinger, ND

'Korando' field pea was seeded on May 12. Early POST (EPOST) treatments were applied on May 27 to 2 node (1" tall) field pea and to downy brome (dobr) in the early boot, tillering volunteer spring wheat (vwht) and 4 leaf Persian darnel (peda) with 76^{o} F, 36 % RH, partly cloudy sky and west wind at 6 mph. Late POST (LPOST) treatments were applied on June 4 to 3 node (3" tall) field pea and to heading downy brome, 5 leaf volunteer spring wheat and to tillering Persian darnel with 61^{o} F, 49 % RH, clear sky and northwest wind at 2 mph. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 10 gpa at 30 psi through PK-01E80 nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The soil is classified as a silt-loam with a pH of 6.2 and OM of 3.2%. The trial was a randomized complete block design with four replications. Downy brome, volunteer wheat and Persian darnel populations averaged 50+, 1 and 5 plants per square foot, respectively. Plots were evaluated for crop injury on June 4 and June 17, and for weed control on June 17. The trial sustained severe hail damage on June 22 and June 24 and was abandoned at that point.

			Application	6/4	---------- June 17 ----------			
	Treatment	Product Rate	Timing	inj	inj	dobr	vwht	peda
		oz / acre						
1	Untreated	--	--	0	0	0	0	0
2	Assure II + MSO	8.0 + 1.0%	EPOST	0	0	91	98	55
3	Assure II + MSO	10.0 + 1.0%	EPOST	0	0	95	99	70
4	Assure II + MSO	12.0 + 1.0%	EPOST	0	0	97	99	70
5	Clethodim + MSO	6.0 + 1%	EPOST	0	0	88	97	50
6	Clethodim + MSO	9.0 + 1%	EPOST	0	0	92	99	72
7	Assure II + MSO	8.0 + 1.0%	LPOST	0	0	58	45	5
8	Assure II + MSO	10.0 + 1.0%	LPOST	0	0	50	55	6
9	Assure II + MSO	12.0 + 1.0%	LPOST	0	0	38	50	4
10	Clethodim + MSO	6.0 + 1%	LPOST	0	0	50	60	8
11	Clethodim + MSO	9.0 + 1%	LPOST	0	0	42	50	4
	C.V. %			0	0	12	8.4	27
	LSD .05			NS	NS	11	8	12

NS = no statistical difference between treatments.

Summary

Cool and wet weather delayed the seeding of this trial by about a month. This delay resulted in application timings that were beyond the optimal growth stages of the targeted weeds. Crop injury was not observed. All early POST treatments provided very good control of downy brome and volunteer wheat. Although all herbicide treatments had activity on Persian darnel, control ratings were quite poor. Additional data is needed to answer rate and timing questions on these weeds.

Pre-harvest weed desiccation in dry pea with Sharpen, Valor, and Paraquat. Jenks, Willoughby, and Hoefing. 'Majoret' dry pea was seeded May 11 at 140 lb/A into 7.5-inch rows into wheat stubble. Desiccation treatments were applied pre-harvest on August 4. Weeds present were common lambsquarters (Colq), kochia (Kocz), and wild buckwheat (Wibw). Individual plots were 10 x 30 ft and replicated four times.

Sharpen + Glyphosate provided at least 90% desiccation of all weeds two weeks after treatment (WAT), whereas desiccation with Sharpen alone ranged from 77-83%. Valor provided 43-66% desiccation and Gramoxone Inteon provided 64-73% desiccation. There were no significant differences in dry pea yield or test weight between treatments. A black sooty mold blanketed the dry peas just before application, thus dry pea desiccation could not be estimated. Note: As of December 2009, Sharpen and Valor are not labeled for use as desiccants in dry pea.

Table. Pre-harvest weed desiccation in dry pea with Sharpen, Valor, and Paraquat (0907).

Treatment[a]	Rate	Colq[b]	Kocz[b]	Wibw[b]	Dry pea	
		2 WAT	2 WAT	2 WAT	Yield	TW
		------------	% control	------------	lb/A	lb/bu
Untreated		0	0	0	2743	66.4
Sharpen + MSO + AMS	2 fl oz + 1% + 2%	83	77	83	2757	66.2
Sharpen + Glyphosate + MSO + AMS	1 fl oz + 1 qt + 1% + 2%	91	91	90	2672	66.1
Valor + MSO	2 oz + 1%	43	66	55	2457	66.2
Gramoxone Inteon + NIS	1.5 pt + 0.25%	68	64	73	2595	65.6
LSD (0.05)		9.6	9.3	12	NS	NS
CV		11	9	13	11	1

[a] *All treatments applied pre-harvest and evaluated 2 weeks after treatment (WAT)*

[b] *Colq =Common lambsquarters; Kocz =Kochia; Wibw =Wild buckwheat*

2009 Sharpen Herbicide in Summer Fallow

Eric Eriksmoen, Hettinger, ND

Treatments were applied on June 17 to 4 inch tall kochia (kocz), 4 inch tall Russian thistle (ruth) and to 8 inch long wild buckwheat with 73° F, 62% RH, partly cloudy sky and southwest wind at 4 mph. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 10 gpa at 30 psi through PK-01E80 nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The soil is classified as a silt-loam with a pH of 6.2 and OM of 3.2%. The trial was a randomized complete block design with three replications. Kochia, Russian thistle and wild buckwheat populations averaged 28, 11 and 3 plants per square foot, respectively. Plots were evaluated for weed control on June 26, July 21 and on August 11.

	Treatment	Product rate	------ June 26 ------			------- July 21 -------			----- August 11 -----		
			kocz	ruth	wibw	kocz	ruth	wibw	kocz	ruth	wibw
		oz/A	% control								
1	Untreated		0	0	0	0	0	0	0	0	0
2	glyphosate + NIS + AMS	32 + 0.25% + 17 lb	96	99	57	93	99	50	92	99	40
3	Sharpen + glyph + MSO + AMS	1.0 + 32 + 1% + 17 lb	99	99	91	96	94	82	93	94	93
4	2,4-D ester + glyph + NIS + AMS	16 + 32 + 0.25% + 17 lb	98	99	87	93	99	62	91	95	27
5	Distinct + glyph + MSO + AMS	2.0 + 32 + 1% + 17 lb	99	99	92	93	98	90	93	93	92
6	Sharpen + Distinct + glyph + MSO + AMS	1.0 + 2.0 + 16 + 1% + 17 lb	96	98	88	95	95	83	93	85	78
7	Sharpen + Distinct + glyph + MSO + AMS	1.0 + 1.0 + 16 + 1% + 17 lb	95	98	96	90	90	88	63	63	63
8	Sharpen + glyph + MSO + AMS	2.0 + 32 + 1% + 17 lb	99	99	99	95	95	93	92	92	95
	C.V. %		2.9	1.4	10.8	3.9	4.5	20.5	10.4	10.9	41.3
	LSD 5%		4	2	14	6	7	25	14	16	44

Summary

All herbicide treatments provided excellent season long kochia and Russian thistle control except for Sharpen + Distinct + glyphosate (trt 7). That treatment provided excellent control initially but declined as the season progressed to unacceptable levels by mid-August. Both 1.0 and 2.0 oz/A Sharpen + glyphosate treatments (trt 3 & 8) and the Distinct + glyphosate treatment (trt 5) provided excellent season long wild buckwheat control.

Kixor/Fallow/Efficacy. Williston 2009. Neil Riveland. WREC.

All treatments were applied on June 14. Air and soil temperatures were 64 degrees F with 61% relative humidity, 99% clear sky and wind at 2-4mph from 89 degrees. Treatments were applied to 3-7 leaf green foxtail (Grft), 2-4 inch Russian thistle (Ruth), 3-4 inch kochia (Kocz) and 8 leaf volunteer safflower(Vsaf). We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 10 gals/a at 40 psi through 8001vs flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. First rain received after application was 0.03 inches on June 18 and 0.17 inches on June 17. Experimental design was a randomized complete block design with four replications. Russian thistle and green foxtail relative densities were medium heavy. Plots were evaluated for weed control on June 16, June 19 and July 1.

Treatment [a]	Product Rate oz/a	-Grft Control- 6/16	6/19	7/1	-Ruth Control- 6/16	6/19	7/1	-Control- Vsaf 6/19	Kocz 6/19
		----- %	------		----- %	------		--- %	---
Untreated Check	0	0	0	0	0	0	0	0	0
Roundup+NIS+AMS	32+.25+17	16	92	99	9	95	100	93	95
Sharpen+Roundup+MSO+AMS	1+32+1+17	49	97	99	93	99	100	99	98
2,4-D ester+Roundup+NIS+AMS	16+32+.25+1	11	91	100	24	89	100	92	88
Distinct+Roundup+MSO+AMS	2+32+1+17	3	95	100	28	89	100	90	93
Sharpen+Distinct+Roundup+MSO+AMS	1+2+16+1+17	61	96	100	79	98	99	98	95
Sharpen+Distinct+Roundup+MSO+AMS	1+1+16+1+17	56	96	100	86	99	99	96	96
Sharpen+Roundup+MSO+AMS	2+32+1+17	61	98	100	95	99	100	99	99
EXP MEAN		32	83	87	52	83	87	83	83
C.V. %		31	3	0	11	5	1	3	5
LSD 5%		15	3	1	9	7	1	5	6

[a] - Roundup PowerMax was used.
NIS = nonionic surfactant Induce
MSO = Adjuvant MSO concentrate
AMS = Ammonium Sulfate (dry) at 17 lbs/100 gals

Summer fallow weed control with Sharpen + glyphosate. Jenks, Willoughby, and Hoefing. The objective of this study was to evaluate broadleaf weed control with Sharpen compared to Glyphosate, 2,4-D amine, and Aim. Herbicide treatments were applied postemergence on June 15. Weeds present included horseweed (5-7", 0-2/ft^2), wild buckwheat (2-3", 1-3/ft^2), kochia (2-12", 0-10/ft^2), common lambsquarters (5-9", 0-2/ft^2), and Russian thistle (3-5", 0-4/ft^2).

All treatments generally provided excellent control of all weeds 4 weeks after treatment (WAT). Sharpen alone at 18 g provided excellent control of horseweed and Russian thistle (90-97%), good control of kochia and lambsquarters (82-86%), but provided poor control of wild buckwheat (50%). This study and other indicated that Sharpen at 18 g is too low to be a consistent broad spectrum stand alone product.

Table. Summer fallow weed control with Sharpen + glyphosate (0946).

		Howe[b]		Wibw[b]		Kocz[b]		Colq[b]		Ruth[b]	
Treatment[a]	Rate/ha	Jun 25	Jul 18	Jun 25	Jul 18	Jun 25	Jul 18	Jun 25	Jul 18	Jun 25	Jul 18
		% control									
Untreated		0	0	0	0	0	0	0	0	0	0
Sharpen[c]	18 g	100	97	62	50	86	82	92	86	100	90
Glyphosate	840 g	93	100	52	91	100	99	100	98	100	100
Sharpen + Glyphosate	18 g + 840 g	100	100	92	96	99	99	100	100	100	100
Sharpen + Glyphosate	25 g + 840 g	100	100	94	95	100	100	100	99	100	100
Sharpen + Glyphosate + Clarity	18 g + 840 g + 140 g	100	100	86	94	100	100	100	100	100	100
Weedar 64 + Glyphosate	560 g + 840 g	95	98	91	95	98	100	99	99	100	100
Aim + Glyphosate	8.97 g + 840 g	85	99	73	89	100	100	100	100	100	100
Sharpen + Glyphosate	25 g + 840 g	100	100	93	96	100	100	100	100	100	100
LSD (0.05)		8.2	4	18	7.7	10.4	8.2	8.3	4.2	NS	5.8
CV		5	3	15	6	7	6	5	3	0	4

[a] *MSO + AMS (1% 2) were applied with all treatments*

[b] *Howe =Horseweed, Wibw =Wild buckwheat, Kocz = Kochia, Colq =Common lambsquarters, Ruth =Russian thistle*

[c] *Sharpen at 18 g/ha is equivalent to 0.75 fl oz/A*

Post-harvest control of common mallow. Jenks, Willoughby, and Hoefing. The objective of the study was to evaluate Sharpen for post-harvest common mallow control. Herbicide treatments were applied post-harvest on September 25 following lentil harvest. Common mallow was 3-8 inches tall with 0-8 plants/ft^2. All treatments were applied at 10 gpa unless otherwise noted.

Treatments containing Sharpen provided 82-87% mallow control 2 WAT compared to 42-47% for glyphosate alone or glyphosate + 2,4-D amine. These results are consistent with a similar study in 2008.

Table. Post-harvest control of common mallow (0943).

Treatment[a]	Rate/ha	Common mallow Oct 02	Common mallow Oct 09
		------% control------	
Untreated		0	0
Sharpen[b]	18 g	83	87
Glyphosate	840 g	20	42
Sharpen + Glyphosate	18 g + 840 g	74	83
Sharpen + Glyphosate	25 g + 840 g	76	84
Weedar 64 + Glyphosate	560 g + 840 g	33	47
Sharpen + Glyphosate (5 gpa)	25 g + 840 g	74	82
LSD(0.05)		5.7	3.6
CV		6	3

[a] *All treatments applied post-harvest, MSO + AMS (1% + 2%) were applied with all treatments*

[b] *Sharpen at 18 g/ha is equivalent to 0.75 fl oz/A*

Yellow toadflax control with DPX-MAT28 in rangeland. Jenks, Willoughby, and Hoefing. The objective of this study was to evaluate DPX-MAT28 for yellow toadflax control in rangeland compared to Tordon. DPX-MAT28 (aminocyclopyrachlor) is an experimental herbicide being developed by DuPont for weed control in rangeland, pasture, and non-cropland areas. Treatments were applied at the vegetative stage (Jul 25), flowering stage (Sep 11), and in late fall (Oct 16) of 2008. The treatments were evaluated for percent visual control in July 2009. Weed density was recorded prior to application in 2008 and again in July 2009.

Tordon provided 23-60% visual control of yellow toadflax and reduced toadflax density 6-55%. DPX-MAT28 at 1.5 oz provided 90-95% visual control and reduced density 84-98%. DPX-MAT28 at 3 oz provided 100% visual control and reduced density 100%. DPX-MAT28 at 2 oz tank mixed with Glean provided 99-100% visual control and reduced density 99-100%. Grass injury from all treatments was 6% or less.

Table. Yellow toadflax control with DPX-MAT28 in rangeland (0949).

			Yellow toadflax	Grass	Yellow toadflax	
Treatment[a]	Rate	Timing	Jul 08	Jul 08	Aug 04, 2008	Jul 14, 2009
			% control	% injury	density per sq ft.	
Untreated			0	0	9.6	11.9
DPX-MAT28	1.5 oz	Vegetative	93	5	8.3	0.2
DPX-MAT28	1.5 oz	Flowering	95	1	6.1	1
DPX-MAT28	1.5 oz	Fall	90	1	7.8	1
DPX-MAT28	3 oz	Vegetative	100	5	8.3	0
DPX-MAT28	3 oz	Flowering	100	3	7.6	0
DPX-MAT28	3 oz	Fall	100	3	5.9	0
Tordon	2 pt	Vegetative	23	1	6.2	5.8
Tordon	2 pt	Flowering	32	1	10.0	6.8
Tordon	2 pt	Fall	60	1	6.4	2.9
DPX-MAT28 + Glean	2 oz + 0.75 oz	Vegetative	99	4	7.9	0.1
DPX-MAT28 + Glean	2 oz + 0.75 oz	Flowering	100	6	7.1	0
DPX-MAT28 + Glean	2 oz + 0.75 oz	Fall	100	3	8.6	0
Untreated			0	0	6.1	6.4
LSD (0.05)			6.8	NS	NS	2.4
CV			6	111	40	56

[a] *MSO (1%) was applied with all treatments*

Flax response to Tembotrione and Topramezone, Fargo. Howatt, Roach, and Harrington. 'York' flax was seeded near Fargo on May 21. Treatments were applied to 2- to 3-inch flax and cotyledon wild mustard (5 to 10/yd^2) on May 28 with 65° F, 61% relative humidity, 0% cloud cover, 4 to 5 mph wind at 315°, and damp soil at 52° F. Treatments following the (/) were applied to three- to four-inch flax, cotyledon to bolting wild mustard (5 to 50/yd^2), two- to six-leaf wild buckwheat (5 to 15/yd^2), and one- to five-inch common lambsquarters (10 to 25/yd^2) on June 24 with 75°F, 56% relative humidity, 10% cloud cover, 2 to 4 mph wind at 270°, and damp soil at 63° F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzles to an area 7 feet wide the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		6/27	7/11	7/11	7/11	7/11
Treatment	Rate	Flax	Flax	Wimu	Wibw	Colq
	oz/A	%	%	%	%	%
Sulfentrazone/brox&MCPA5+clet+MSO	4/8+1+16	7	11	96	91	99
Mesotrione/brox&MCPA5+clet+MSO	2/8+1+16	6	9	98	75	96
Mesotrione/brox&MCPA5+clet+MSO	3/8+1+16	7	15	98	81	98
/Tembotrione	0.9	5	6	82	20	15
/Tembotrione	1.3	6	8	93	22	15
/Topramezone	0.18	5	6	91	0	10
/Topramezone	0.25	7	9	95	10	10
/Brox&MCPA5+clet+MSO	8+1+16	12	8	92	45	92
/Clpy&MCPA+clet+MSO	7.3+1+16	10	8	93	72	96
/Tembotrione+brox&MCPA5+clet+MSO	0.9+8+1+16	13	14	97	85	97
/Tembotrione+clpy&MCPA+clet+MSO	0.9+7.3+1+16	12	14	95	80	98
/Topramezone+brox&MCPA5+clet+MSO	0.18+8+1+16	11	13	96	75	94
/Topramezone+clpy&MCPA+clet+MSO	0.18+7.3+1+16	9	10	97	87	97
/Tembotrione+clet+MSO	0.9+1+16	6	12	90	7	25
/Topramezone+clet+MSO	0.18+1+16	6	7	94	20	17
Untreated	0	0	2	0	0	0
CV		34	34	2	18	5
LSD 5%		4	5	3	13	5

Soil moisture seemed to predispose flax to herbicide injury and even resulted in crop response on July 11. Tembotrione and topramezone caused lasting injury that tended to increase as the season progressed. Chlorosis, stunting, and leaf deformity was observed for several weeks. Previous observations that flax may be tolerant of these new products were identified with less herbicide. Field use rates appropriate for weed control will carry exceptional risk of crop injury.

Flax response to Tembotrione and Topramezone, Casselton. Howatt, Roach, and Harrington. 'York' flax was seeded near Casselton on May 28. Treatments were applied to 3- to 5-inch flax and 1- to 3-inch redroot pigweed, wild mustard, common lambsquarters, Venice mallow, and yellow foxtail on June 26 with 73° F, 64% relative humidity, 0% cloud cover, 4 to 5 mph wind at 315°, and moist soil at 63°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzles to an area 7 feet wide the length of 10 by 30 ft plots. The experiment was a randomized compete block design with four replicates for the June 30 evaluation and two replicates for the July 10 evaluations.

		6/30	7/10	7/10	7/10	7/10	7/10	7/10
Treatment	Rate	Flax	Flax	Rrpw	Wimu	Colq	Vema	Yeft
	oz/A	%	%	%	%	%	%	%
Tembotrione	0.9	3	5	20	82	0	0	15
Tembotrione	1.3	3	7	42	85	0	0	15
Topramezone	0.18	4	6	15	85	0	0	10
Topramezone	0.25	5	9	30	82	5	30	35
Brox&MCPA5+clet+MSO	8+1+16	8	10	30	87	97	47	15
Clpy&MCPA+clet+MSO	7.3+1+16	4	7	67	94	96	85	98
Tembotrione+brox&MCPA5+clet+MSO	0.9+8+1+16	8	40	99	99	98	96	96
Tembotrione+clpy&MCPA+clet+MSO	0.9+7.3+1+16	6	20	97	97	99	92	95
Topramezone+brox&MCPA5+clet+MSO	0.18+8+1+16	9	40	93	98	96	91	92
Topramezone+clpy&MCPA+clet+MSO	0.18+7.3+1+16	5	12	94	99	98	80	95
Tembotrione+clet+MSO	0.9+1+16	3	11	48	84	77	30	94
Topramezone+clet+MSO	0.18+1+16	2	12	10	57	7	0	63
Untreated	0	0	0	0	0	0	0	0
CV		25	34	60	27	17	41	43
LSD 5 %		2	8	53	39	16	31	43

Flax injury was very pronounced when tembotrione or topramezone were applied with bromoxynil. These combinations caused substantial bleaching and necrosis resulting in 40% injury. This was much greater injury than in Fargo but flax was under more stress in Casselton than Fargo, as indicated by very slow growth rate prior to herbicide application. But as in Fargo, injury became more severe as the season progressed. There appears to be too much injury potential for either product to be a viable weed control option for flax.

Pre-harvest weed desiccation in lentil with Sharpen, Valor, and Paraquat. Jenks, Willoughby, and Hoefing. 'Pennell' lentil was seeded May 18 at 95 lb/A into 7.5-inch rows into wheat stubble. Desiccation treatments were applied pre-harvest on August 25. Weeds present were common lambsquarters (Colq), kochia (Kocz), and redroot pigweed (Rrpw). Individual plots were 10 x 30 ft and replicated four times.

Sharpen + Glyphosate provided more weed desiccation (74-90%) than other treatments two weeks after treatment (WAT). Desiccation with Sharpen alone ranged from 38-71%. Valor provided 20-61% desiccation and Gramoxone Inteon provided 26-70% desiccation. These numbers are significantly lower compared to a similar study in dry pea applied August 4. Mean temperatures seven days before and after the lentil application were about five degrees warmer than the early August dry pea application. Approximately 0.72 inches of precipitation fell within three days after the dry pea application, but there was no rain after the lentil application. The warmer, drier conditions in late August may have contributed to the lower weed desiccation in the lentil study. There were no significant differences in lentil yield or test weight between treatments. Note: As of December 2009, Sharpen and Valor are not labeled for use as desiccants in lentil.

Table. Pre-harvest weed desiccation in lentil with Sharpen, Valor, and Paraquat (0908).

		Colq[b]		Kocz[b]		Rrpw[b]		Lentil	
Treatment[a]	Rate	1 WAT	2 WAT	1 WAT	2 WAT	1 WAT	2 WAT	Yield	TW
		-----% desiccation-----						lb/A	lb/bu
Untreated		0	0	0	0	0	0	1066	58.1
Sharpen + MSO + AMS	2 fl oz + 1% + 2%	25	38	29	58	40	71	1138	59.0
Sharpen + Glyphosate + MSO + AMS	1 fl oz + 1 qt + 1% + 2%	18	78	13	74	35	90	1019	59.4
Valor + MSO	2 oz + 1%	15	20	20	38	13	61	983	58.7
Gramoxone Inteon + NIS	1.5 pt + 0.25%	19	26	30	55	47	70	995	58.6
LSD (0.05)		7.7	7.4	13.1	13.5	25.1	27.1	NS	NS
CV		5	5	9	9	16	17	22	1

[a]*All treatments were applied pre-harvest and evaluated 1 and 2 weeks after treatment (WAT)*

[b]*Colq=Common lambsquarters; Kocz=Kochia; Rrpw=Redroot pigweed*

Lentil tolerance to experimental herbicides. Jenks, Willoughby, and Hoefing. 'Pennell' lentil was seeded May 18 at 95 lb/A into 7.5-inch rows into wheat stubble. Glyphosate was applied preplant over the entire study area on May 14. Herbicides treatments were applied preemergence (PRE) on May 21. Individual plots were 10 x 30 ft and replicated three times.

The objective of the study was to evaluate lentil response to experimental herbicides applied PRE. As of December 2009, Express, Prowl, Sharpen, KIH-485, Spartan, and Valor are not labeled for PRE use in lentil. All treatments caused at least 10% visual injury 6 weeks after treatment (WAT). Lentil in most treatments recovered to less than 10% injury by 8 WAT. Valor at 2 and 3 oz caused 17 to 37% injury at 8 WAT. Treatments containing Sharpen or Valor tended to have lower test weight. Pursuit + Prowl provided excellent control of wild buckwheat (Wibw), redroot pigweed (Rrpw), and common lambsquarters (Colq). Prowl tank mixed with either Express or Sharpen provided poor control of all weeds. Valor and KIH-485 generally provided poor to fair weed control. Spartan provided good control of wild buckwheat and lambsquarters, but only fair control of pigweed. Treatments with better weed control tended to have higher yield. Valor caused the most crop injury and also had the lowest lentil yield.

Table. Lentil tolerance to experimental herbicides (0916).

		Lentil		Wibw[b]		Rrpw[b]		Colq[b]		Lentil	
Treatment[a]	Rate	Jul 01	Jul 25	Jul 01	Jul 25	Jul 01	Jul 25	Jul 01	Jul 25	Yield	TW
		--% injury--		--------------------% control--------------------						lb/A	lb/bu
Untreated		0	0	0	0	0	0	0	0	849	55.2
Express + Prowl H20	0.25 oz + 2 pt	12	1	75	43	69	43	81	48	969	55.1
Sharpen + Prowl H20	1 fl oz + 2 pt	10	3	71	48	61	37	72	52	924	49.8
Pursuit + Prowl H20	2 fl oz + 2 pt	16	8	97	92	99	97	100	97	1337	59.8
KIH-485	0.15 lb ai	16	7	57	38	85	79	65	50	1147	57.6
KIH-485	0.3 lb ai	25	7	53	38	89	83	74	63	996	58.7
Valor	2 oz	21	17	74	61	77	60	76	58	806	54.3
Valor	3 oz	39	37	86	66	86	63	84	61	447	55.3
Spartan	3 fl oz	16	5	91	83	81	63	91	91	1218	58.8
Handweeded[c]		12	3		96		92		94	1270	59.5
LSD (0.05)		8.8	8.3	20.7	27.8	10.3	14.4	17.7	22	338	3.8
CV		5	5	12	16	6	8	10	13	20	4

[a] *All treatments applied PRE*

[b] *Wibw =Wild buckwheat; Rrpw =Redroot pigweed; Colq =Common lambsquarters*

[c] *Prowl H2O (2 pt) was applied PRE to aid handweeding*

Weed control in lentil, Williston 2009. Neil Riveland

'Richlea' lentil was planted on May 5 into 2008 safflower stubble using a JD 750 notill drill with 7 inch row spacing at 70 lbs/a. All PE treatments were applied on May 11 to a dry soil surface with 65 F, 29% RH, 75% clear sky and wind at 3-5 mph from 159 degrees with topsoil at 60 F. The post emergence treatments were applied on June 5 to 3-4 inch lentils and 2-4 inch Russian thistle (Ruth), 1-1.5 inch prostrate pigweed (prpw) and green foxtail (grft) 3-6 leaf stage with 42 degree F, 64% RH, 95% clear sky, wind at 2-4 mph from 36 degrees, dry plant and soil surfaces, with soil temperature at 57 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply all treatments. PE treatments were applied through 8002 flat fan nozzles delivering 20 gals/a at 40 psi. Post treatments were applied though 8001 flat fan nozzles delivering 10 gal/a at 40 psi. Plot size was 6.67 ft wide area the length of 10 by 30 ft plots. Glyphosate was applied to the whole plot area on April 20 to control emerged weeds. First rain received after PE applications were 0.24 inch on May 11. First rain event after post treatment was 0.34 inches on June 6. The experiment was a randomized complete block design with three replications. Plots were evaluated for crop injury and weed control June 14 and August 2. Russian thistle density was heavy at 4-5 plants/sq ft, green foxtail at 6-8 plts/sq ft and prostrate pigweed at 1/2-2 plts/sq ft. Lentils were machine harvested on August 12.

Treatment	Product Rate-Unit/a	Type	% Crop Injury 6/14	% Crop Injury 8/2	Test Weight lbs/bu	Grain Yield lbs/a	Ruth 6/14	Ruth 8/2	Prpw 6/14	Grft 8/2
							------%Control-----			
Untreated			0	0	61.0	1349	0	0	0	0
Express & Prowl	0.25 oz/a&2 pt/a	Pre	2	2	61.2	1713	75	30	82	42
Sharpen & Prowl	1 fl oz/a&2 pt/a	Pre	3	0	61.4	2397	45	60	85	37
Pursuit & Prowl	2 fl oz/a&2 pt/a	Pre	5	2	61.5	2028	66	58	92	65
KIH-485	0.15 lb/a	Pre	2	0	61.0	1776	0	10	57	27
KIH-485	0.30 lb/a	Pre	3	0	61.1	1240	0	20	42	38
Valor	2 oz/a	Pre	9	3	61.2	1511	92	83	96	37
Valor	3 oz/a	Pre	18	18	60.8	1614	97	98	99	60
Spartan	3 fl oz/a	Pre	7	0	61.1	1540	78	77	93	0
Prowl H2O	2 pt/a	Pre	1	0	61.0	1582	40	28	68	33
Metribuzen	8 oz/a	Pre	3	0	61.1	1337	0	20	72	0
Metribuzen	6 oz/a	Post	8	0	60.9	1433	20	0	43	0
Raptor	4 oz/a	Post	7	17	60.3	359	43	17	67	87
HIGH MEAN			18	18	61.5	2397	97	98	99	87
LOW MEAN			0	0	60.3	359	0	0	0	0
EXP MEAN			5	3	61.0	1529	43	39	69	33
C.V. %			52	74	.6	15	32	56	26	61
LSD 5%			5	4	NS	381	23	36	30	34
LSD 1%			6	5	NS	517	31	49	40	45
# OF REPS			3	3	2	3	3	3	3	3
F-TRT			9	22	1.3	13	22	7	8	6

Valor and Raptor caused significant crop injury. Sharpen and Pursuit in combination with Prowl H2O did not control Russian thisle as well as Valor but those treatments resulted in the highest lentil yields.

<u>**Residual Weed Control from Lentil Treated with Valor Herbicide**</u>

Eric Eriksmoen, Hettinger, ND

'CDC Richlea' lentil was seeded on May 14, 2008. Treatments were applied on August 3 to lentils that were at physiologic maturity with 83° F, 34% RH, clear sky and NW wind at 6 mph. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 20 gpa at 30 psi through PK-01E80 nozzles to the length of 5 by 28 foot plots. 'Reeder' HRSW was seeded on May 14, 2009. No herbicide was applied during the 2009 growing season. The trial was not harvested.

Treatment	Product Rate	- May 20 - inj.	- May 20 - kocz	- June 12 - inj.	- June 12 - kocz
	oz/A	-------- % control --------			
Untreated		0	0	0	0
Valor + Superb + AMS	2.0 + 32 + 2.5 lbs	0	83	0	60
Gramoxone + NIS	20.8 + 0.25%	0	80	0	23
Valor + glyphosate + Superb + AMS	2.0 + 22 + 32 + 2.5 lbs	0	90	0	60
Glyphosate + Superb + AMS	22 + 32 + 2.5 lbs	0	67	0	23
C.V. %		0	11	0	51
LSD .05		NS	13	NS	32

NS = no statistical difference between treatments

<u>**Summary**</u>

Crop injury was not observed. All herbicide treatments showed significant early season suppression of kochia. The Valor + glyphosate treatment expressed excellent early season control. This control diminished as the season progressed, however, both Valor alone and Valor + glyphosate treatments had significantly higher season long kochia control than the other treatments. This trial demonstrates the crop safety and short term benefits of Valor Herbicide applied in a pre or post harvest scenario.

Pyroxasulfone tolerance of Pea and Lentil. Hunt, Ryan L. and Richard K. Zollinger. Experiments were setup in both 2008 and 2009 near Minot, Williston, and Carrington, ND. Peas were planted in 2008 on May 8, May 6, and April 30 at Minot, Williston, and Carrington respectively. PRE applications were applied on May 14, May 6, and May 6 at Minot, Williston, and Carrington. Peas were planted in 2009 on May 12, April 24, and May 15 at Minot, Williston, and Carrington. PRE applications were applied May 14, May 6, and May 18. Lentils were planted in 2008 on May 14, May 6, and April 30 at Minot, Williston, and Carrington. PRE applications were applied on May 15, May 6, and May 6 at Minot, Williston, and Carrington. Lentils were planted in 2009 at Minot, Williston, and Carrington on May 18, May 4, and May 15. PRE applications were made on May 22, May 6, and May 18 at Minot, Williston, and Carrington. No weeds were present at the time of all PRE applications. Standard herbicide treatments were used in postemergence situations as well as handweeding to keep plots free of weeds.

Minimal rainfall at the start of the growing season in both years resulted in insufficient weed control, which is evidence of a lack of herbicide activation.

Due to extreme drought conditions the Williston site was abandoned in 2008.

Pea. No visual injury or significant differences were observed at all locations in 2008 and 2009.

Lentil. No visual injury or significant differences were observed at all locations in 2008 and Williston and Carrington in 2009. Injury was observed at high rates in 2009 at Minot; however plants had grown out of it by the 56 DAE rating and injury was not significantly affected.

(Dept. of Plant Sciences, North Dakota State University, Fargo).

2008 Pea Tolerance to Pyroxasulfone (Hunt and Zollinger)

Treatment	Rate	Minot yield	Williston yield	Carrington yield
	(g/ha)	(kg/ha)	(kg/ha)	(kg/ha)
Pyroxasulfone	84	2289a	-	1796a
	125	2096a	-	1790a
	166	1850a	-	1720a
	332	1767a	-	1625a
Sulfentrazone	105	2586a	-	1646a
LSD		952	-	155

2009 Pea Tolerance to Pyroxasulfone (Hunt and Zollinger)

Treatment	Rate	Minot yield	Williston yield	Carrington yield
	(g/ha)	(kg/ha)	(kg/ha)	(kg/ha)
Pyroxasulfone	84	4240a	1956a	1456a
	125	4091a	1965a	1362a
	166	4528a	2030a	1454a
	332	4029a	2121a	1566a
Sulfentrazone	105	4622a	2004a	1324a
LSD		915	246	317

2008 Lentil Tolerance to Pyroxasulfone (Hunt and Zollinger)

Treatment	Rate (g/ha)	Minot yield (kg/ha)	Williston yield (kg/ha)	Carrington yield (kg/ha)
Pyroxasulfone	84	2088a	-	1179a
	125	2390a	-	1370a
	166	2243a	-	968a
	332	2458a	-	1104a
Pendimethalin	560	2338a	-	1049a
LSD		385	-	405

2009 Lentil Tolerance to Pyroxasulfone (Hunt and Zollinger)

		Minot				Williston	Carrington
		14 DAE	28 DAE	56 DAE			
Treatment	Rate (g/ha)	% injury	% injury	% injury	yield (kg/ha)	yield (kg/ha)	yield (kg/ha)
Pyroxasulfone	84	2d	4d	0b	1621a	868a	1739a
	125	4c	8c	0b	1295a	926a	1455a
	166	8b	14b	3b	1430a	955a	1167a
	332	15a	21a	8a	1459a	1200a	1380a
Pendimethalin	560	0d	0e	0b	1446a	1156a	1688a
LSD		2	3	4	493	340	870

Micro-rate Application Timings for Weed Control in Onion - Great Bend. James R. Loken and Harlene Hatterman-Valenti.

An experiment that was conducted to evaluate the most effective number of sequential micro-rate applications for early-season, broadleaf weed control in onion (*Allium cepa* L.). The soil was a clay loam that was four years removed from a feed lot operation. Onion variety 'Teton' pelleted seed was planted at 285,000 seeds/A using a Milton planter on May 20. Plots were 6 ft wide by 20 ft long and arranged in a randomized complete block design with four replicates. At the time of weed cotyledon stage (June 4) herbicides were applied as micro-rates at 1/8 of their lowest labeled rate every 7 days, with three, four, and five total applications. Micro-rate herbicide applications were made with a CO_2 pressurized backpack sprayer. A standard application of bromoxynil (0.38 lb ae/A) and oxyfluorfen (0.25 lb ai/A) was applied on July 8 (3-leaf stage) to control broadleaf weeds, and a single reduced rate application (1/4 the lowest labeled rate) of bromoxynil and oxyfluorfen was made on August 3 (7-leaf stage) as a final late-season broadleaf weed control measure. Best management practices were used for fertility, disease, insect, and grass weed control. Treatments were visual evaluated for overall control of redroot pigweed and common lambsquarters after all micro-rate treatments were completed on July 8. On September 30, 5 ft of the middle two rows of each plot were harvested for grade and yield analysis. Split and diseased bulbs were graded as culls regardless of diameter.

Table 1. Herbicide application dates, crop stage, and environmental conditions at Great Bend, ND, 2009.

Application Date:	6-4	6-9	6-17	6-24	6-30	7-8	8-3
Onion Stage:	Loop	Flag-loop	1-2 lf	2 lf	2-3 lf	3 lf	7 lf
Air Temp. (F):	61	57	65	73	63	75	70
Wind speed (MPH):	7	3.5	4	1	7	0	5
Operating pressure:	40 psi	40 psi	40 psi	40 psi	40 psi	40 psi	40 psi
Nozzle type:	Flat fan	Flat fan	Flat fan	Flat fan	Flat fan	Flat fan	Flat fan
Nozzle size:	8002	8002	8002	8002	8002	8002	8002
Volume (GPA):	20	20	20	20	20	20	20

Visual ratings indicated common lambsquarters control with herbicides was greatest with bromoxynil applied four or five times and oxyfluorfen applied five times (Table 2). None of the herbicide treatments provided control of common lambsquarters as great as the hand weeded check. Redroot pigweed control was sufficient across all herbicides and all application timings due to the late emergence, cool temperatures, and poor weed growth during the entire season. Oxyfluorfen applied five times provided control as great as the hand weeded check. There were no yield differences (regardless of grade) within herbicides across application timings, indicating the importance of season long weed control. Cool summer temperatures were unfavorable for crop growth, but favored continuous flushes of common lambsquarters, further reducing yields.

Table 2. Effect of three, four, or five micro-rate herbicide applications on weed control and yield in onion at Great Bend, ND.

Treatment			Visual Evaluations		Yield		
Herbicide	App[1]	Rate (herb + MSO)	Colq[2]	Rrpw[3]	Medium[4]	Large[5]	Total
		product/A	------% control------		----------------------cwt/A----------------------		
Bromoxynil	3	2 oz + 0.5% v/v	13.8	86.3	39.6	6.3	68.4
Bromoxynil	4	2 oz + 0.5% v/v	66.3	86.3	132.5	102.6	290.8
Bromoxynil	5	2 oz + 0.5% v/v	73.8	91.3	192.7	88.2	341.2
Oxyflourfen[6]	3	1 oz + 0.5% v/v	33.8	91.3	113.4	85.5	245.8
Oxyflourfen	4	1 oz + 0.5% v/v	40.0	90.0	161.2	61.2	271.9
Oxyflourfen	5	1 oz + 0.5% v/v	57.5	96.3	179.2	90.0	312.4
Hand weeded check	--	--	100.0	100.0	172.0	90.0	314.2
Weedy check	--	--	0	0	0	0	0
LSD	--	--	21	5.6	126.7	NS	183.8

[1]application, [2]common lambsquarters [3]redroot pigweed, [4]medium grade is 2.25-3 inches, [5]large grade is $\geq$ 3 inches, [6]oxyfluorfen water-based formulation

Simulated glyphosate drift to red potatoes. Harlene M. Hatterman-Valenti and Collin P. Auwarter.

This study was conducted at the Northern Plains Potato Growers Association Non-irrigated research site near Grand Forks, ND to evaluate the effect of glyphosate drift to current season growth and yield for three commonly grown red cultivars (Red Norland, Red LaSoda, and Sangre). Plots were 4 rows by 25 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36-inch rows and 12-inch spacing on June 10, 2009. Plots were 4 rows by 25 ft arranged in a split-block design with cultivar as the main factor and the combination of application timing and herbicide rate as sub-plots with 3 replicates. Glyphosate was applied with a CO_2 pressurized sprayer equipped with 8001XR flat fan nozzles with a spray volume of 5 GPA and a pressure of 35 psi. The first application timing (TI) occurred on July 23, 2009. Extension recommendations were used for cultural practices throughout the year. Plots were desiccated on September 19, harvested October 11 and graded into the various categories after harvest.

Date:	7/23/09	8/6/09	9/9/09
Treatment:	TI	EB	LB
Air temperature (F):	59	74	75
Rel. hum. (%):	92	47	45
Wind (mph):	3	3	12
Soil moisture:	above normal	above normal	above normal
Cloud cover (%):	50	90	0

Red Norland appeared to be the most sensitive cultivar to glyphosate. Plants treated with glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage produced significantly more cull tubers (< 4 oz) compared to the untreated control. In contrast, potatoes treated with glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage produced significantly less 4-6 oz. tubers compared to the untreated and other treatments. This resulted in 37 to 50% decrease in marketable tubers size-wise. Unfortunately, excessive tuber cracking and russet skinning occurred with most of the tubers in these application timings, further reducing marketable yields. A slight shift to smaller tubers occurred when plants were treated with 0.063 lb ai/A glyphosate at the EB stage. No yield differences and few visible tuber defects were observed when plants were treated with glyphosate at the LB stage.

Red LaSoda was the next most sensitive cultivar to glyphosate. Plants treated with 0.25 lb ai/A glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage produced significantly more cull tubers (< 4 oz) compared to the untreated control. Other grade categories were similar regardless of the glyphosate treatments. Marketbale yields were reduced 34 to 57% when plants were treated with 0.25 lb ai/A glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage. Excessive tuber cracking and russet skinning was most severe in the EB stage with 70 to 100% rejection of marketable tubers due to visible tuber defects.

Sangre was the least sensitive tested cultivar to glyphosate. Plants treated with 0.25 lb ai/A glyphosate at the TI or EB stage produced significantly more cull tubers (< 4 oz) compared to the untreated control. Other grade categories were similar regardless of the glyphosate treatments. Marketbale yields were reduced 31 to 58% when plants were treated with 0.25 lb ai/A glyphosate at the TI or EB stage. Excessive tuber cracking and russet skinning was most severe in the EB stage with 30 to 100% rejection of marketable tubers due to visible tuber defects.

Potato cultivar yield and grade in response to glyphosate

Treatment	0-4 oz		4-6 oz		6-10 oz		>10 oz		TOTAL		>4 oz	
	CWT/A											
Red Norland Chk	73	c-h	140	a-d	52	abc	50	def	316	a-e	243	a-f
Red Norland TI Glyphosate 0.25	65	c-h	64	a-f	30	abc	26	ef	184	cde	120	d-g
Red Norland TI Glyphosate 0.13	75	c-h	51	c-f	25	abc	16	ef	167	de	92	efg
Red Norland TI Glyphosate 0.06	153	a	60	b-f	12	bc	4	f	229	a-e	76	fg
Red Norland EB Glyphosate 0.25	105	a-f	39	f	11	c	1	f	157	e	52	g
Red Norland EB Glyphosate 0.13	131	ab	45	def	9	c	8	f	193	b-e	62	g
Red Norland EB Glyphosate 0.06	104	a-f	139	a-d	32	abc	16	ef	291	a-e	187	a-g
Red Norland LB Glyphosate 0.25	76	c-h	152	ab	66	a	35	ef	329	a-e	253	a-e
Red Norland LB Glyphosate 0.13	75	c-h	132	a-f	54	abc	33	ef	295	a-e	220	a-g
Red Norland LB Glyphosate 0.06	58	d-h	147	ab	63	a	47	def	315	a-e	257	a-e
Red LaSoda Chk	40	h	124	a-f	62	a	161	ab	387	a	347	a
Red LaSoda TI Glyphosate 0.25	107	a-e	77	a-f	26	abc	66	c-f	276	a-e	169	a-g
Red LaSoda TI Glyphosate 0.13	46	fgh	122	a-f	69	a	136	abc	373	abc	327	ab
Red LaSoda TI Glyphosate 0.06	50	e-h	113	a-f	55	abc	123	a-d	342	a-e	292	a-d
Red LaSoda EB Glyphosate 0.25	112	a-d	115	a-f	31	abc	4	f	261	a-e	149	b-g
Red LaSoda EB Glyphosate 0.13	102	b-g	83	a-f	31	abc	21	ef	237	a-e	135	c-g
Red LaSoda EB Glyphosate 0.06	60	c-h	146	abc	69	a	60	c-f	336	a-e	275	a-d
Red LaSoda LB Glyphosate 0.25	45	gh	110	a-f	66	a	152	ab	374	abc	329	ab
Red LaSoda LB Glyphosate 0.13	47	fgh	121	a-f	65	a	146	ab	379	ab	332	ab
Red LaSoda LB Glyphosate 0.06	43	gh	113	a-f	64	a	150	ab	369	abc	327	ab
Sangre Chk	36	h	104	a-f	57	ab	151	ab	348	a-d	312	abc
Sangre TI Glyphosate 0.25	117	abc	43	ef	10	c	8	f	178	de	61	g
Sangre TI Glyphosate 0.13	33	h	111	a-f	67	a	170	a	381	ab	348	a
Sangre TI Glyphosate 0.06	71	c-h	157	a	69	a	85	b-f	383	ab	312	abc
Sangre EB Glyphosate 0.25	86	b-h	75	a-f	26	abc	27	ef	214	a-e	128	c-g
Sangre EB Glyphosate 0.13	71	c-h	138	a-e	66	a	63	c-f	338	a-e	267	a-e
Sangre EB Glyphosate 0.06	47	fgh	123	a-f	67	a	97	a-e	334	a-e	287	a-d
Sangre LB Glyphosate 0.25	52	e-h	128	a-f	67	a	84	b-f	331	a-e	279	a-d
Sangre LB Glyphosate 0.13	42	gh	109	a-f	61	a	135	abc	347	a-e	305	a-d
Sangre LB Glyphosate 0.06	49	e-h	114	a-f	58	a	118	a-d	339	a-e	290	a-d
LSD (P=.05)	32		52		26		48		102		103	

Potato cultivar tuber set in response to glyphosate

Treatment	0-4 oz		4-6 oz		6-10 oz		>10 oz		TOTAL		>4 oz	
	Tuber no.											
Red Norland Chk	93	d-h	67	abc	19	abc	11	d-g	191	bc	97	abc
Red Norland TI Glyphosate 0.25	132	c-g	29	a-e	11	abc	6	fg	178	bc	46	b-e
Red Norland TI Glyphosate 0.13	118	c-h	24	b-e	9	abc	4	fg	156	bc	38	cde
Red Norland TI Glyphosate 0.06	273	a	31	a-e	4	bc	1	g	309	a	37	cde
Red Norland EB Glyphosate 0.25	177	bc	20	e	4	bc	0	g	201	bc	24	e
Red Norland EB Glyphosate 0.13	182	bc	24	cde	4	c	2	g	211	bc	29	de
Red Norland EB Glyphosate 0.06	138	c-f	71	a	12	abc	3	fg	225	bc	87	a-d
Red Norland LB Glyphosate 0.25	95	d-h	70	a	25	a	8	fg	198	bc	103	abc
Red Norland LB Glyphosate 0.13	90	d-h	63	a-e	20	abc	8	fg	181	bc	91	abc
Red Norland LB Glyphosate 0.06	74	e-h	68	ab	22	a	10	efg	175	bc	101	abc
Red LaSoda Chk	52	fgh	55	a-e	21	a	33	a	161	bc	109	ab
Red LaSoda TI Glyphosate 0.25	162	bcd	37	a-e	9	abc	14	c-g	222	bc	60	a-e
Red LaSoda TI Glyphosate 0.13	58	fgh	54	a-e	23	a	27	a-d	162	bc	104	abc
Red LaSoda TI Glyphosate 0.06	67	e-h	50	a-e	20	abc	25	a-e	163	bc	96	abc
Red LaSoda EB Glyphosate 0.25	145	cde	59	a-e	11	abc	1	g	217	bc	71	a-e
Red LaSoda EB Glyphosate 0.13	129	c-g	40	a-e	12	abc	5	fg	186	bc	57	a-e
Red LaSoda EB Glyphosate 0.06	70	e-h	66	a-d	24	a	13	c-g	173	bc	103	abc
Red LaSoda LB Glyphosate 0.25	52	fgh	47	a-e	23	a	32	a	154	c	102	abc
Red LaSoda LB Glyphosate 0.13	56	fgh	53	a-e	23	a	29	abc	161	bc	105	abc
Red LaSoda LB Glyphosate 0.06	56	fgh	48	a-e	22	a	30	ab	157	bc	101	abc
Sangre Chk	41	h	46	a-e	20	abc	31	a	139	c	97	abc
Sangre TI Glyphosate 0.25	220	b	22	de	4	c	2	g	247	b	28	de
Sangre TI Glyphosate 0.13	40	h	47	a-e	23	a	32	a	142	c	102	abc
Sangre TI Glyphosate 0.06	78	e-h	74	a	24	a	18	a-g	194	bc	116	a
Sangre EB Glyphosate 0.25	118	c-h	37	a-e	10	abc	6	fg	171	bc	53	a-e
Sangre EB Glyphosate 0.13	88	d-h	64	a-e	23	a	15	b-g	190	bc	102	abc
Sangre EB Glyphosate 0.06	55	fgh	55	a-e	23	a	20	a-f	154	c	98	abc
Sangre LB Glyphosate 0.25	58	fgh	58	a-e	23	a	18	a-g	157	bc	99	abc
Sangre LB Glyphosate 0.13	48	gh	48	a-e	21	a	26	a-e	143	c	95	abc
Sangre LB Glyphosate 0.06	53	fgh	50	a-e	21	ab	26	a-e	150	c	97	abc
LSD (P=.05)	47		24		9		10		49		37	

Effect of glyphosate droplet concentration on drift injury to irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.

A study was conducted at the Northern Plains Potato Grower's Association Irrigation Research site near Inkster, ND to determine if increasing the glyphosate droplet concentration by reducing the water volume would increase injury to potato and whether this increase in injury would be similar at all growth stages. This was accomplished by comparing plant and tuber injury from glyphosate applied at 20, 5, or 1 GPA to 'Russet Burbank' plants at the tuber initiation (TI), early bulking (EB), and late bulking stages (LB). The potato variety 'Russet Burbank' was planted on May 24 using a Harrison double-row planter with 12-inch spacing between seed pieces and 36 inches between rows. Glyphosate was applied at one-sixth, and one-twelfth the standard use rate (0.125 and 0.0625 lb ai/A) with a CO_2-pressurized ATV sprayer equipped with HB/HC #2 and #5 nozzles with a spray volume of 20 GPA (70 psi and 1.8 mph), 5 GPA (25 psi and 3.6 mph), or 1 GPA (25 psi and 7.2 mph). AMS was included to the spray solution and reduced accordingly. The field design was a randomized complete block, factorial arrangement, with four replicates. Maintenance programs were conducted throughout the growing season to apply fungicides and insecticides. Plants were harvested September 25 with a single-row Hasia harvester and then graded at Fargo. Application, environmental, crop, and yield data are listed below:

Date:	7/23/09	8/6/09	9/9/09
Treatment:	TI	EB	LB
Air temperature (F):	68	70	73
Rel. hum. (%):	62	61	57
Wind (mph):	7	6	8
Wind direction:	SE	SE	SW

Visual injury symptoms from glyphosate applications were subtle (chlorosis at growing points) regardless of glyphosate rate or application timing. Plants treated with glyphosate recovered quicker and showed less injury symptoms than previous years due to better environmental conditions in 2009. Plants treated with 0.13 lb/A glyphosate at the TI stage when applied at 20 GPA or at the EB stage when applied at 5 GPA had significant marketable and total yield loss from the reduction in tuber size. Plants treated with glyphosate produced similar number of tubers in comparison to the untreated except when plants were treated with 0.06 lb/A glyphosate applied at 20 GPA at the TI stage, which had significantly more tubers. Additional tuber loss would have occurred if tubers were to be sold for fresh market due to growth cracks and elephant hide skin in many of the tubers when plants were treated with glyphosate at the TI or EB stage.

Potato tuber set in response to glyphosate droplet concentration.

Treatment	< 4 oz	4-6 oz	6-8 oz	8-10 oz	10-12 oz	>12 oz	Total	>4 oz
	tuber no.							
Untreated	97	45	28	20	7	8	205	108
RU 0.125 TI 20 GPA	159	20	7	4	2	1	192	33
RU 0.0625 TI 20 GPA	217	51	22	9	6	3	307	91
RU 0.125 TI 1 GPA	103	47.8	34	20	9	8	221	118
RU 0.0625 TI 1 GPA	140	42	27	11	6	5	230	90
RU 0.125 EB 20 GPA	130	56	43	18	6	4	257	127
RU 0.0625 EB 20 GPA	105	59	43	24	10	9	249	145
RU 0.125 EB 5 GPA	151	45	19	4	3	2	224	73
RU 0.0625 EB 5 GPA	129	58	33	14	5	5	243	115
RU 0.125 EB 1 GPA	141	54	34	12	5	5	250	109
RU 0.0625 EB 1 GPA	120	54	37	16	5	7	239	119
RU 0.125 LB 20 GPA	108	51	33	17	6	7	222	114
RU 0.0625 LB 20 GPA	114	56	33	19	8	10	239	125
RU 0.125 LB 5 GPA	113	57	33	20	8	7	237	124
RU 0.0625 LB 5 GPA	126	60	35	20	10	10	260	134
RU 0.125 LB 1 GPA	129	61	32	14	8	4	247	118
RU 0.0625 LB 1 GPA	124	60	31	19	7	2	243	119
LSD (P=0.05)	47	20	13	9	4	NS	76	40

Potato yield and grade in response to glyphosate droplet concentration.

Treatment	< 4 oz	4-6 oz	6-8 oz	8-10 oz	10-12 oz	>12 oz	Total	>4 oz
				Cwt/A				
Untreated	93	102	82	71	33	46	426	334
RU 0.125 TI 20 GPA	119	49	21	16	9	6	220	101
RU 0.0625 TI 20 GPA	156	91	54	29	24	18	371	215
RU 0.125 TI 1 GPA	83	87	86	65	34	42	397	315
RU 0.0625 TI 1 GPA	123	97	90	48	34	36	428	305
RU 0.125 EB 20 GPA	104	102	107	58	23	19	413	309
RU 0.0625 EB 20 GPA	82	106	107	77	38	51	460	379
RU 0.125 EB 5 GPA	120	81	48	13	10	9	280	160
RU 0.0625 EB 5 GPA	102	105	84	44	19	24	377	275
RU 0.125 EB 1 GPA	120	97	83	39	20	24	382	262
RU 0.0625 EB 1 GPA	98	98	91	51	20	35	393	295
RU 0.125 LB 20 GPA	92	93	84	55	23	35	381	289
RU 0.0625 LB 20 GPA	85	99	82	63	31	52	412	327
RU 0.125 LB 5 GPA	93	104	82	64	32	35	409	316
RU 0.0625 LB 5 GPA	100	109	88	64	38	53	451	351
RU 0.125 LB 1 GPA	100	111	81	46	30	18	386	286
RU 0.0625 LB 1 GPA	102	108	76	61	28	11	386	284
LSD (P=0.05)	32	33	29	28	15	26	101	85

Use of fomesafen (Reflex) in Irrigated Potato. Harlene Hatterman-Valenti and Collin Auwarter.

Field research was conducted at the Northern Plains Potato Growers Association Irrigation Research site near Inkster, ND to evaluate potato tolerance and weed control of fomesafen +/- s-metolachlor or +/- prepackaged mix of s-metolachor and metribuzin to standards using four popular varieties grown under irrigation in North Dakota (Blazer, Russet Norkotah, Shepody, and Dakota Pearl). Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 24, 2009. Plots were 4 rows by 20 ft arranged in a randomized complete block design with 4 replicates. Herbicide treatments were applied 24 DAP with a CO_2 pressurized sprayer equipped with 8002 flat fan nozzles with a spray volume of 20 gpa and a pressure of 40 psi. Extension recommendations were used for cultural practices throughout the year. At time of application Blazer was 80% emerged, Russet Norkotah was 75%, Shepody was 60%, and Dakota Pearl was 95%. Plants emerged at application ranged from barely poking through soil up to 1 inch in height. Injury was expected since the application timing was pre-emergence to crop and weeds.

Application Date:	6/17/09
Air Temperature (F):	67
Rel. Humidity (%):	62
Wind (mph):	4
Soil Moisture:	Below Normal
Cloud Cover (%):	100

Dakota Pearl, with the most emerged plants, showed the greatest tolerance with 5 to 16% injury 5 DAA from applications with fomesafen. Other varieties had 6 to 28% visual injury with chlorosis as the main symptom. Potatoes treated with fomesafen and the premix of s-metolachlor plus metribuzin (Reflex @ 2 pt/a + Boundary @ 4 pt/a) had the greatest injury 5 DAA; Blazer-26%, Russet Norkotah and Shepody-28%, and Dakota Pearl-16%. This treatment also provided 100% control of common lambsquarters throughout the trial. By 14 DAA, all treatments where fomesafen was applied still showed signs of injury ranging between 1 to 9%, and by 26 DAA, only slight chlorosis was observed (0 to 2%). Treatments with fomesafen alone had less control of common lambsquarters than treatments tank mixed with either a prepackaged mix of s-metolachor and metribuzin, metribuzin, s-metolachlor, of rimsulfuron throughout the trial. Russet Norkotah had the greatest yields, while Blazer was the lowest yielding variety. The marketable yields (>4 oz) were similar to total yields. Dakota Pearl had the greatest tuber counts with the untreated having the most tubers in 20 ft of row (259 tubers). However, this variety also had the most unmarketable tubers, having between 53 and 69% of the tubers considered culls. Shepody had the lowest tuber number with all treatments having less than 141 tubers in 20 ft of row. Herbicide treatments had only slight effect on potato yield and grade due to low weed density/ competitive pressure. The trial location reportedly had high weed pressure, but due to the delay in being able to work the field and plant, most weeds were controlled with the hilling procedure just prior to herbicide applications.

Effect of herbicide treatments on common lambsquarters control, Blazer injury, and yield.

No.	Name	Rate	Rate Unit	Colq ---6/22/09-- % Con.	% Inj.	Colq ---7/1/09---- % Con.	% Inj.	Colq --7/13/09--- % Con.	% Inj.	Colq ---8/13/09-- % Con.	% Inj.	<4oz	4-6oz	6-8oz	8-10oz	10-12oz	>12oz	Total	>4oz
												---CWT/A---							
1	Untreated			0	0	0	0	0	0	0	0	69	84	60	49	16	19	298	228
2	Reflex	1	pt/a	81	9	86	2	86	0	76	0	51	72	82	60	42	57	364	313
3	Reflex	2	pt/a	89	16	91	5	90	0	86	0	59	75	59	55	36	23	308	249
4	Dual Magnum	1.33	pt/a	90	5	95	1	88	0	91	0	46	83	77	51	28	28	312	266
5	Reflex	1	pt/a	100	21	98	6	96	1	96	0	42	56	69	71	38	54	331	288
	Dual Magnum	1.33	pt/a																
6	Boundary	2	pt/a	99	4	100	1	99	0	100	0	58	74	84	51	36	60	363	305
7	Reflex	0.5	pt/a	100	18	100	4	100	0	100	0	57	68	77	51	30	31	314	256
	Boundary	2	pt/a																
8	Reflex	1	pt/a	100	21	100	4	100	0	100	0	46	63	75	77	53	50	364	318
	Boundary	2	pt/a																
9	Reflex	2	pt/a	100	26	100	9	100	1	100	0	52	55	55	45	27	39	274	222
	Boundary	4	pt/a																
10	Sencor	0.25	lb/a	100	3	100	0	100	0	100	0	53	72	70	68	32	27	323	270
	Boundary	2	pt/a																
11	Matrix	1.5	oz/a	100	4	100	1	99	0	100	0	50	68	70	64	45	62	360	309
	Boundary	2	pt/a																
12	Sencor	0.25	lb/a	100	25	100	6	100	0	100	0	51	78	95	60	48	45	376	325
	Reflex	1	pt/a																
	Boundary	2	pt/a																
13	Matrix	1.5	oz/a	100	20	100	7	100	0	100	0	46	62	67	73	43	42	332	286
	Reflex	1	pt/a																
	Boundary	2	pt/a																
LSD	(P=0.05)			3	4	3	2	3	NS	7	NS	21	20	27	28	22	27	65	64

Effect of herbicide treatments on common lambsquarters control, Russet Norkotah injury, and yield.

No.	Name	Rate	Rate Unit	Colq ---6/22/09-- % Con.	% Inj.	Colq ---7/1/09---- % Con.	% Inj.	Colq --7/13/09--- % Con.	% Inj.	Colq ---8/13/09-- % Con.	% Inj.	<4oz	4-6oz	6-8oz	8-10oz	10-12oz	>12oz	Total	>4oz
												-----	-----	-----	---CWT/A---	-----	-----	-----	-----
1	Untreated			0	0	0	0	0	0	0	0	59	76	109	94	61	88	487	428
2	Reflex	1	pt/a	84	10	91	5	91	1	85	0	62	87	99	88	54	100	489	427
3	Reflex	2	pt/a	90	14	95	6	97	1	99	0	51	64	80	111	80	157	542	491
4	Dual Magnum	1.33	pt/a	91	5	93	3	90	1	93	0	71	95	92	91	61	91	502	430
5	Reflex	1	pt/a	99	24	99	9	96	0	99	0	54	74	87	89	57	107	469	414
	Dual Magnum	1.33	pt/a																
6	Boundary	2	pt/a	100	7	100	3	100	0	98	0	59	71	96	87	91	123	526	467
7	Reflex	0.5	pt/a	100	19	100	8	100	0	100	0	45	84	101	86	62	121	499	453
	Boundary	2	pt/a																
8	Reflex	1	pt/a	100	23	100	5	100	0	100	0	52	62	88	83	74	128	487	435
	Boundary	2	pt/a																
9	Reflex	2	pt/a	100	28	100	9	100	1	100	0	49	67	96	85	59	104	460	410
	Boundary	4	pt/a																
10	Sencor	0.25	lb/a	100	4	100	1	100	0	100	0	57	83	89	90	62	144	524	467
	Boundary	2	pt/a																
11	Matrix	1.5	oz/a	100	2	100	0	100	0	100	0	70	84	94	109	82	84	524	454
	Boundary	2	pt/a																
12	Sencor	0.25	lb/a	100	21	100	6	100	0	100	0	54	67	83	84	67	98	454	399
	Reflex	1	pt/a																
	Boundary	2	pt/a																
13	Matrix	1.5	oz/a	100	23	100	6	100	0	100	0	63	73	95	92	58	132	513	449
	Reflex	1	pt/a																
	Boundary	2	pt/a																
LSD	(P=0.05)			4	6	2	3	2	NS	6	NS	NS	24	26	24	26	27	65	64

Effect of herbicide treatments on common lambsquarters control, Shepody injury, and yield.

No.	Name	Rate	Rate Unit	Colq ---6/22/09-- % Con.	% Inj.	Colq ---7/1/09---- % Con.	% Inj.	Colq --7/13/09--- % Con.	% Inj.	Colq ---8/13/09-- % Con.	% Inj.	<4oz	4-6oz	6-8oz	8-10oz	10-12oz	>12oz	Total	>4oz
												---CWT/A---							
1	Untreated			0	0	0	0	0	0	0	0	34	63	66	63	64	118	407	374
2	Reflex	1	pt/a	86	6	95	2	93	2	96	0	41	55	89	67	63	122	437	396
3	Reflex	2	pt/a	93	9	97	6	97	2	94	0	46	62	84	70	65	115	443	397
4	Dual Magnum	1.33	pt/a	98	11	95	1	89	1	96	0	41	69	83	68	61	102	424	383
5	Reflex	1	pt/a	100	23	100	2	96	0	99	0	35	63	66	79	69	166	478	443
	Dual Magnum	1.33	pt/a																
6	Boundary	2	pt/a	100	15	100	2	100	0	100	0	29	56	71	79	57	144	435	406
7	Reflex	0.5	pt/a	99	20	98	1	99	0	100	0	40	70	88	81	69	99	447	408
	Boundary	2	pt/a																
8	Reflex	1	pt/a	100	23	100	3	100	0	100	0	38	47	63	71	62	147	427	389
	Boundary	2	pt/a																
9	Reflex	2	pt/a	100	28	100	6	100	1	100	0	29	41	59	87	72	146	434	405
	Boundary	4	pt/a																
10	Sencor	0.25	lb/a	100	11	100	2	100	0	100	0	34	63	79	82	66	133	457	423
	Boundary	2	pt/a																
11	Matrix	1.5	oz/a	100	3	100	2	100	1	100	0	37	63	70	80	74	156	481	443
	Boundary	2	pt/a																
12	Sencor	0.25	lb/a	100	24	100	4	100	1	100	0	31	56	75	64	76	137	440	409
	Reflex	1	pt/a																
	Boundary	2	pt/a																
13	Matrix	1.5	oz/a	100	24	100	6	100	2	100	0	36	47	83	68	58	142	432	396
	Reflex	1	pt/a																
	Boundary	2	pt/a																
LSD	(P=0.05)			3	5	3	4	2	1	4	NS	NS	19	28	NS	NS	NS	65	68

Effect of herbicide treatments on common lambsquarters control, Dakota Pearl injury, and yield.

No.	Name	Rate	Rate Unit	Colq ---6/22/09-- % Con.	% Inj.	Colq ---7/1/09--- % Con.	% Inj.	Colq --7/13/09--- % Con.	% Inj.	Colq ---8/13/09-- % Con.	% Inj.	<4oz	4-6oz	6-12oz	>12oz	Total	>4oz
												CWT/A					
1	Untreated			0	0	0	0	0	0	0	0	190	138	98	12	438	248
2	Reflex	1	pt/a	84	5	88	1	93	0	84	0	142	133	87	9	371	229
3	Reflex	2	pt/a	86	5	95	2	96	0	86	0	156	140	95	15	406	251
4	Dual Magnum	1.33	pt/a	86	1	91	0	89	0	85	0	165	135	96	19	415	250
5	Reflex	1	pt/a	98	5	100	2	98	0	99	0	139	151	124	27	441	302
	Dual Magnum	1.33	pt/a														
6	Boundary	2	pt/a	100	0	100	0	99	0	100	0	181	135	93	16	426	244
7	Reflex	0.5	pt/a	100	5	100	1	99	0	99	0	159	138	98	20	415	257
	Boundary	2	pt/a														
8	Reflex	1	pt/a	100	8	100	2	100	0	99	0	179	112	67	6	365	186
	Boundary	2	pt/a														
9	Reflex	2	pt/a	100	16	100	4	99	0	100	0	138	125	118	25	407	269
	Boundary	4	pt/a														
10	Sencor	0.25	lb/a	100	1	100	0	100	0	100	0	163	134	78	17	392	229
	Boundary	2	pt/a														
11	Matrix	1.5	oz/a	99	1	100	0	100	0	100	0	169	123	75	12	380	211
	Boundary	2	pt/a														
12	Sencor	0.25	lb/a	100	9	100	3	100	0	100	0	153	125	105	10	393	240
	Reflex	1	pt/a														
	Boundary	2	pt/a														
13	Matrix	1.5	oz/a	100	14	100	3	100	0	99	0	133	129	107	17	386	253
	Reflex	1	pt/a														
	Boundary	2	pt/a														
LSD	(P=0.05)			5	3	3	1	3	NS	6	NS	38	NS	NS	NS	NS	95

Use of Metribuzin for weed control in irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.

Field research was conducted at the Northern Plains Potato Growers Association Irrigation Research site near Inkster, ND to compare the efficacy and selectivity of metribuzin when applied pre and post to Russet Burbank potatoes. Seed pieces (2oz) were planted on 36 inch rows and 12 inch spacing on May 23, 2009. Plots were 4 rows by 25 ft arranged in a randomized complete block design with 4 replicates. Extension recommendations were used for cultural practices throughout the year. The herbicide treatments were applied to the middle 2 of 4 rows using a CO_2 pressurized backpack sprayer equipped with 8002 flat fan nozzles with an output of 20 gpa and a pressure of 40 psi on June 16 ('A') and on June 25 ('B'). Weed control evaluations were done on June 22 (6 DAA 'A'), July 1 (15 DAA 'A', 6 DAA 'B'), July 16 (30 DAA 'A', 21 DAA 'B'), and August 13 (58 DAA 'A', 49 DAA 'B'). We harvested both treated rows on September 26.

Application Date:	6/16/09	6/25/09		6/16/09	6/25/09
Air Temperature (F):	67	76	: Soil Moisture:	Below Normal	Adequate
Rel. Humidity (%):	76	36	Cloud Cover (%)	100	0
Wind (mph):	8	5			

Effect of herbicide on weed control and yield.

No.	Name	Rate	Rate Unit	Code	Rrpw	Colq	Grft	Rrpw	Colq	Grft	Rrpw	Colq	Grft	Rrpw	Colq	Grft	Yield
					--------6/22/09--------			--------7/1/09--------			--------7/16/09-------			-------8/13/09--------			
					------% Control-------			-----% Control------			-----% Control------			-----% Control------			CWT/A
1	Untreated				0	0	0	0	0	0	0	0	0	0	0	0	285
2	Metribuzin	10.7	oz/a	A	100	94	100	100	100	100	100	100	100	100	100	100	418
3	Metribuzin	21.3	oz/a	A	100	100	99	100	100	100	99	99	99	100	100	100	389
4	Sencor	10.7	oz/a	A	100	95	100	96	99	100	100	98	100	100	100	100	401
5	Metribuzin	5.33	oz/a	B	0	0	0	90	90	93	98	89	98	95	93	100	418
6	Metribuzin	10.7	oz/a	B	0	0	0	90	90	98	100	91	98	100	100	100	407
7	Sencor	5.33	oz/a	B	0	0	0	93	90	100	100	92	100	98	98	100	412

Ratings on June 22 showed excellent control on redroot pigweed and green foxtail. Common lambsquarters, which was the most populated weed in the field, was completely controlled (100%) with metribuzin @ 21.3 oz/a (treatment 3), while metribuzin @ 10.7 oz/a (treatment 2) and Sencor @ 10.7 oz/a (treatment 4) had 94 and 95% control, respectively. July 1 ratings showed 100% control for the 3 weeds with both metribuzin pre-emergence treatments (2 and 3), while the post-emergence treatments showed between 90 and 93% control for redroot pigweed and common lambsquarters. By trials end, all pre-emergence treatments (2-4) and metribuzin @ 10.7 oz/a post-emergence treatment (6) had 100% control of all 3 weeds, while the lower rate of metribuzin post-emergence (treatment 5) showed 95% control of redroot pigweed and 93% control of common lambsquarters. The post-emergence Sencor treatment (7) had 98% control of both redroot pigweed and common lambsquarters. The untreated control yielded 284 cwt/A, while all other treatments (2-7) yielded between 391 and 421 cwt/A.

Use of saflufenacil with multiple adjuvants as a desiccant on dryland potatoes - Glyndon.

Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted north of Glyndon, MN to compare desiccation with saflufenacil (BAS 800) when applied with different adjuvants. Red Norland seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 10, 2009. Plots were 4 rows by 30 feet arranged in a randomized complete block design with 3 replicates. The treatments were applied to the middle 2 of 4 rows using a CO2 backpack sprayer equipped with 8002 flat fan nozzles with an output of 20 gpa and a pressure of 40 psi on September 2.

Application Date:	9/2/09		
Air Temperature (F):	79	Wind (mph):	7
Rel. Humidity (%):	49	Soil Moisture:	Adequate
Cloud Cover (%):	50		

Potato desiccation with saflufenacil alone and tank mixed with adjuvants.

				-----9/5/09-----		----9/11/09----		----9/16/09----	
			Rate	----3 DAA----		----9 DAA----		----14 DAA----	
No.	Name	Rate	Unit	Leaves	Stems	Leaves	Stems	Leaves	Stems
1	BAS 800	2	floz/a	5cd	0b	33b	10de	99a	88b
2	BAS 800	2	floz/a	18bc	8b	77a	23bcd	100a	98a
	Class Act NG	2.5	%v/v						
	InterLock	2	floz/a						
3	BAS 800	2	floz/a	23b	7b	82a	18cd	98a	98a
	NPAK AMS Liquid	2.5	%v/v						
	AG 06011	6	floz/a						
4	BAS 800	2	floz/a	28b	15b	87a	33bc	100a	100a
	Class Act NG	2.5	%v/v						
	InterLock	2	floz/a						
	Destiny HC	1	pt/a						
5	BAS 800	2	pt/a	17bc	6b	75a	18cd	100a	97a
	Class Act NG	2.5	%v/v						
	InterLock	2	floz/a						
	Superb HC	1	pt/a						
6	BAS 800	2	floz/a	28b	13b	87a	27bcd	100a	98a
	NPAK AMS Liquid	2.5	%v/v						
	Destiny (MSO)	1	%v/v						
7	BAS 800	2	floz/a	25b	13b	80a	33bc	100a	98a
	AG 07043	1	%v/v						
8	BAS 800	2	floz/a	33b	15b	87a	42b	100a	100a
	NPAK AMS Liquid	2.5	%v/v						
	Prime Oil	1	%v/v						
9	BAS 800	2	floz/a	30b	12b	82a	28bcd	100a	100a
	Class Act NG	2.5	%v/v						
	AG 07010	1	pt/a						
10	BAS 800	2	floz/a	35b	15b	87a	35bc	100a	100a
	Class Act NG	2.5	%v/v						
	InterLock	2	floz/a						
	AG 08047	1	pt/a						
11	BAS 800	2	floz/a	32b	17b	87a	43b	100a	98a
	Class Act NG	2.5	%v/v						
	AG 08050	0.5	%v/v						
12	Reglone	2	pt/a	60a	37a	95a	65a	100a	100a
	AdWet	1	pt/100gal						
13	Unterated			0d	0b	0c	0e	0b	0c

Treatments were applied when plants were beginning to senescence. At 3 DAA the treatment with saflufenacil alone (1) was significantly slower desiccating than the other treatments showing only 5% leaf necrosis while the treatment with Reglone (12) showed 60%. Saflufenacil + Class Act NG + InterLock (treatment 2) and the addition of Superb HC (treatment 5) had slower desiccation than replacing Superb HC with AG 08047 (treatment 10) at 3 DAA. At 9 DAA, the Reglone treatment had 95% leaf necrosis, but this was not significant against any of the other treatments except for treatment 1 where saflufenacil was applied alone. By the end of the trial, all treatments had at least 98% leaf necrosis and at least 97% stem necrosis, except for the saflufenacil alone treatment with only 88%.

Use of Eptam for weed control in irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.
A study was conducted west of Inkster, ND at the Northern Plains Potato Growers Association Irrigation Research site to evaluate several Eptam based programs with Dual II Magnum + Sencor for weed control in irrigated 'Russet Burbank' potatoes. Plots were 4 rows by 25 ft arranged in a randomized complete block design with 4 replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 23, 2009. Treatments were applied prior to planting ('A') and after hilling ('B'), but prior to emergence. Extension recommendations were used for cultural practices throughout the year. The herbicide treatments were applied to the middle two rows using a CO_2 backpack sprayer equipped with 8002 flat-fan nozzles with an output of 20 gpa and a pressure of 40 psi. Weed control was evaluated on June 22, July 14, and August 13. Treated rows were harvested on September 26 and graded at Fargo.

Application Date:	5/23/09	6/16/09
Air Temperature (F):	65	67
Rel. Humidity (%):	60	76
Wind (mph):	2	8
Soil Moisture:	Adequate	Below normal
Cloud Cover (%):	0	100

Table 1. Effect of herbicide treatments on weed control.

				Colq	Rrpw	Grft	Colq	Rrpw	Grft	Colq	Rrpw	Grft
		Rate		-------6/22/09------			---------7/14/09---------			---------8/13/09---------		
Name	Rate	Unit	Code	-----% Control-----			---------Control---------			------% Control--------		
Untreated				0	0	0	0	0	0	0	0	0
Eptam	5.5	pt/a	A	96	100	99	94	100	100	98	98	100
Eptam +	4.5	pt/a	A	100	100	100	100	100	100	100	100	100
Sencor	0.33	lb/a	B									
Eptam +	4.5	pt/a	A	100	100	100	100	100	100	100	100	100
Matrix	1.5	oz/a	B									
Dual II	2	pt/a	B	100	100	100	100	100	100	100	100	100
Magnum+												
Sencor	0.33	lb/a	B									

Table 2. Effect of herbicide treatments on potato yield and grade.

		Rate		<4oz	4-6oz	6-8oz	8-10oz	10-12oz	>12oz	Total	>4oz
Name	Rate	Unit	Code	--------------------------------CWT/A-----------------------------------							
Untreated				144	133	81	42	13	11	424	279
Eptam	5.5	pt/a	A	149	119	70	25	19	17	400	251
Eptam +	4.5	pt/a	A	126	118	77	45	16	17	399	273
Sencor	0.33	lb/a	B								
Eptam +	4.5	pt/a	A	135	103	82	47	19	26	413	278
Matrix	1.5	oz/a	B								
Dual II	2	pt/a	B	141	132	78	51	16	20	438	297
Magnum +											
Sencor	0.33	lb/a	B								

Weed control evaluations showed all treatments performed well. The new location did not have the weed pressure previously reported. Total yields showed no differences and that the untreated performed as well as any other treatment. This was attributed to the limited weed pressure. There was no significant difference in grade. All treatments had between 63 and 68% of their tubers greater than the 4 oz size. Results indicate that Eptam and Eptam combinations provide similar weed control as the combination of Dual II Magnum + Sencor and that plants treated with these herbicides had similar yields and grades.

Weed control using CHA-023 on irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.

A study was conducted at the Northern Plains Potato Growers Association Irrigation Research site near Inkster, ND to determine the efficacy and selectivity of CHA-023 applied pre and early post to Russet Burbank potatoes. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 28, 2009. Plots were 4 rows by 25 ft arranged in a randomized complete block design with 4 replicates. Extension recommendations were used for cultural practices throughout the year. The herbicide treatments were applied to the middle 2 of 4 rows using a CO_2 backpack sprayer equipped with 8002 flat fan nozzles with an output of 20 gpa and a pressure of 40 psi on June 16 ('A') and June 25 ('B'). Weed control evaluations were done on June 22 (6 DAA 'A'), July 1 (15 DAA 'A', 6 DAA 'B'), July 16 (30 DAA 'A', 21 DAA 'B'), and August 13 (58 DAA 'A', 49 DAA 'B'). Potatoes were harvested on September 26. Plants in this trial emerged rather quickly as this land was first tilled the day before planting and deep ripping was not available, hence the seed pieces were not planted as deeply as planned (4 inches versus 6 inches below the soil surface) and were in slightly warmer soil. At hilling, plants were beginning to emerge (5%) and the disk cultivator was unable to get enough soil to throw on top of the hill to properly cover emerged potato plants and weeds. When application 'A' was applied, common lambsquarters were at 2-3 leaves and about half inch tall.

Application Date:	6/16/09	6/25/09
Air Temperature (F):	67	76
Rel. Humidity (%):	76	36
Wind (mph):	8	5
Soil Moisture:	Below Normal	Adequate
Cloud Cover (%):	100	0

Weed control evaluations.

No.	Name	Rate	Rate Unit	Code	Colq 6/22/09 % Control	Colq -------7/1/09------- -----% Control-----	Rrpw	Grft	Colq ------7/16/09------ -----% Control-----	Rrpw	Grft	Colq -------8/13/09------- -----% Control-----	RRpw	Grft	Yield cwt/a
1	Untreated				0	0	0	0	0	0	0	0	0	0	239
2	CHA-023	0.75	oz/a	A	50	61	63	71	64	73	78	73	80	88	340
3	CHA-023	1.5	oz/a	A	68	65	65	73	65	73	88	69	69	100	310
4	CHA-023	3	oz/a	A	63	61	61	63	81	83	78	65	76	88	295
5	Matrix	1.5	oz/a	A	75	68	68	76	68	69	68	65	75	75	358
6	CHA-023	0.75	oz/a	B	0	90	90	91	91	94	100	100	100	100	356
	Preference	0.25	%v/v	B											
7	CHA-023	1.5	oz/a	B	0	90	90	91	95	99	74	100	100	100	341
	Preference	0.25	%v/v	B											
8	CHA-023	3	oz/a	B	0	91	91	90	98	99	100	100	100	100	369
	Preference	0.25	%v/v	B											
9	Matrix	1.5	oz/a	B	0	90	90	93	94	94	100	100	100	100	354
	Preference	0.25	%v/v	B											

Common lambsquarters was the only weed rated on June 22, and Matrix @ 1.5 oz/a (treatment 5) showed the best results with 75% control. If there would have been a surfactant tank mixed with application timing "A" treatments, the results may have improved. The pre-emergence treatments (2-5) struggled throughout the year, but did show better results as the season went on. CHA-023 @ 0.75 oz/a pre-emergence (treatment 2) had the best results of the pre treatments by the end of the year with 73% control of common lambsquarters and 80% of redroot pigweed. The post-emergence treatments, with the surfactant (Preference @ 0.25% v/v), provided the best season-long weed control. All had 100% control of common lambsquarters, redroot pigweed, and yellow foxtail. The highest yielding treatment was CHA-023 @ 3 oz/a + Preference @ 0.25% v/v (treatment 8) with 369 cwt/a, followed by Matrix @ 1.5 oz/a (treatment 5) with 358 cwt/a. The untreated control yielded 239 cwt/a.

Use of saflufenacil with multiple adjuvants as a desiccant on dryland potatoes. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Growers Association non-irrigated research site near Grand Forks, ND to compare desiccation with saflufenacil (BAS 800) when applied with different adjuvants. Red Norland seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 11, 2009. Plots were 4 rows by 25 ft arranged in a randomized complete block design with 4 replicates. Extension recommendations were used for cultural practices throughout the year. The desiccant treatments were applied to the middle 2 of 4 rows using a CO_2 backpack sprayer equipped with 8002 flat fan nozzles with an output of 20 gpa and a pressure of 40 psi on August 31. Potatoes were harvested on October 13.

Application Date:	9/3/09
Air Temperature (F):	74
Rel. Humidity (%):	68
Wind (mph):	2
Soil Moisture:	Adequate
Cloud Cover (%):	5

Potato desiccation with saflufenacil alone and tank mixed with adjuvants.

					-----9/8/09-----		----9/10/09----		----9/14/09----		----9/17/09----		Yield	Yield
			Rate		----8 DAA----		---10 DAA---		---14 DAA---		---17 DAA---		Row A	Row B
No.	Name	Rate	Unit	Code	Lvs	Stem	Lvs	Stem	Lvs	Stem	Lvs	Stem	cwt/A	cwt/A
1	BAS 800	2	floz/a	A	50c	18b	88b	38b	98a	88b	100a	99a	360a	362a
2	BAS 800	2	floz/a	A	63b	23a	94a	39b	100a	93ab	100a	100a	417a	389a
	Class Act NG	2.5	%v/v	A										
	InterLock	2	floz/a	A										
3	BAS 800	2	floz/a	A	73ab	28a	96a	51ab	100a	97a	100a	100a	357a	348a
	Class Act NG	2.5	%v/v	A										
	InterLock	2	floz/a	A										
	Destiny HC	1	pt/a	A										
4	BAS 800	2	floz/a	A	70ab	25a	95a	49ab	100a	94ab	100a	100a	383a	381a
	Class Act NG	2.5	%v/v	A										
	InterLock	2	floz/a	A										
	Superb HC	1	pt/a	A										
5	BAS 800	2	floz/a	A	80a	36a	96a	65a	100a	97a	100a	100a	394a	387a
	NPAK AMS Liquid	2.5	%v/v	A										
	Destiny (MSO)	1	%v/v	A										
6	BAS 800	2	floz/a	A	71ab	28a	96a	55ab	100a	95ab	100a	100a	409a	371a
	Class Act NG	2.5	%v/v	A										
	AG 07010	1	pt/a	A										

Treatments were applied when plants were beginning to senescence. At 8 DAA the treatment with saflufenacil alone (1) showed slower desiccation on both leaves and stems than treatments tank mixed with adjuvants. Saflufenacil + NPAK AMS Liquid + Destiny (MSO) (treatment 5) had the highest percentage of desiccation during each rating. By trials end (17 DAA) leaves on all treatments had 100% desiccation and all stems had 100% desiccation except saflufenacil alone, which had 99%. Total yield was not significantly different.

Pyraflufen (Vida) and Aceto-diquat as a desiccant on dryland potatoes. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Northern Plains Potato Growers Association Non-irrigated research site near Grand Forks, ND to compare desiccation with Vida at different rates and timings compared with diquat. Red Norland seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on June 11, 2009. Plots were 4 rows by 25 ft arranged in a randomized complete block design with 4 replicates. Extension recommendations were used for cultural practices throughout the year. The desiccant treatments were applied to the middle 2 of 4 rows using a CO_2 backpack sprayer equipped with 8002 flat fan nozzles with an output of 20 gpa and a pressure of 40 psi on September 3 ('A') and September 10 ('B'). The pH of water before adding Vida to the bottles was 5.85. We added Tri-Fol @ 1 pt/100 gal to lower the pH. Potatoes were harvested on October 13.

Application Date:	9/3/09	9/10/09
Air Temperature (F):	74	77
Rel. Humidity (%):	68	73
Wind (mph):	2	7
Soil Moisture:	Adequate	Above Normal
Cloud Cover (%):	5	10

Anything with diquat faired better than the Vida treatments throughout the trial on both the leaves and stems. By 4 DAA 'A' the Vida treatments had between 21 and 29% leaf necrosis, while the treatments with diquat (including ones tank mixed with Vida) had between 36 and 41% leaf necrosis, with the highest being Vida @ 4.125 floz/a + Reglone @ 1 pt/a + Preference @ 0.25% v/v (treatment 4). All stems at this point showed between 10 and 20% necrosis. By 14 DAA 'A' and 7 DAA 'B' the best treatment was Vida @ 4.125 floz/a + Reglone @ 1 pt/a + Preference @ 0.25% v/v (treatment 4) with 96% leaf necrosis and 86% stem necrosis. The next best treatment was Vida @ 2.75 floz/a + Reglone @ 1 pt/a + Preference @ 0.25% v/v (treatment 6) applied 2X with 95% desiccated leaves and 84% desiccated stems. During the last ratings (18 DAA 'A' and 11 DAA 'B') all treatments had 100% desiccation of leaves, except the treatments where Vida was not tank mixed with any other herbicide (treatments 2 and 3). All stems at this point were at least 96% desiccated. All treatments had a yield between 335 and 441 cwt/A with no statistical difference between treatments. The highest yielding treatments were Vida @ 5.5 floz/a + Persist Ultra @ 1% v/v (treatment 2) with 441 cwt/A, and Reglone @ 1 pt/a + Preference fb Vida @ 2.75 floz/a + Persist Ultra @ 1% v/v (treatment 10) with 425 cwt/A. The lowest yielding was a Aceto-diquat @ 2 pt/a + Preference @ 0.25% v/v (treatment 13) with 335 cwt/a. The untreated (treatment 1) yielded 397 cwt/a.

Potato desiccation with pyraflufen and diquat.

					-----9/7/09------		-----9/10/09-----		-------9/17/09-------		--------9/21/09---------		
			Rate		4 DAA'A'		7 DAA'A'		14 DAA'A', 7 DAA'B'		18 DAA'A', 11 DAA'B'		Yield
No.	Name	Rate	Unit	Code	Leaves	Stems	Leaves	Stems	Leaves	Stems	Leaves	Stems	cwt/a
1	Untreated				0c	0d	0e	0e	0d	0d	0c	0c	397a
2	*Vida	5.5	floz/a	A	23b	10c	53cd	23d	86bc	73c	99b	96b	441a
	Persist Ultra	1	%v/v	A									
3	*Vida	5.5	floz/a	A	29b	13bc	55cd	25cd	85c	75bc	99b	97ab	354a
	Syl-Tac	4	floz/a	A									
4	*Vida	4.125	floz/a	A	41a	19a	69a	35a	96a	86a	100a	100a	392a
	Reglone	1	pt/a	A									
	Preference	0.25	%v/v	A									
5	*Vida	2.75	floz/a	A	38a	18a	66ab	33ab	91abc	79abc	100a	100a	356a
	Reglone	1	pt/a	A									
	Preference	0.25	%v/v	A									
6	*Vida	2.75	floz/a	AB	39a	20a	70a	35a	95a	84ab	100a	100a	403a
	Reglone	1	pt/a	AB									
	Preference	0.25	%v/v	AB									
7	*Vida	2.75	floz/a	AB	23b	13bc	55cd	25cd	86bc	74bc	100a	97ab	373a
	Persist Ultra	1	%v/v	AB									
8	*Vida	2.75	floz/a	A	25b	13bc	53cd	26bcd	86bc	73c	100a	98ab	357a
	Persist Ultra	1	%v/v	A									
	*Vida	5.5	floz/a	B									
	Persist Ultra	1	%v/v	B									
9	*Vida	2.75	floz/a	A	21b	10c	48d	21d	90abc	80abc	100a	99a	395a
	Persist Ultra	1	%v/v	A									
	Reglone	1	pt/a	B									
	Preference	0.25	%v/v	B									
10	Reglone	1	pt/a	A	36a	19a	66ab	31abc	93abc	80abc	100a	99a	425a
	Preference	0.25	%v/v	A									
	*Vida	2.75	floz/a	B									
	Persist Ultra	1	%v/v	B									
11	Reglone	1	pt/a	A	35a	16ab	68ab	35a	94ab	83abc	100a	100a	356a
	Preference	0.25	%v/v	A									
	Reglone	1	pt/a	B									
	Preference	0.25	%v/v	B									
12	Aceto-diquat	1	pt/a	A	38a	19a	65ab	33ab	89abc	79abc	100a	98ab	342a
	Preference	0.25	%v/v	A									
13	Aceto-diquat	2	pt/a	A	39a	19a	70a	38a	93abc	83abc	100a	100a	335a
	Preference	0.25	%v/v	A									
14	Aceto-diquat	1	pt/a	A	36a	19a	59bc	30abc	91abc	83abc	100a	99a	386a
	Preference	0.25	%v/v	A									
	Aceto-diquat	1	pt/a	B									
	Preference	0.25	%v/v	B									

*pH was brought down to 5.85 by adding Tri-Fol @ 1 pt/100 gal before adding Vida.

Postemergence weed control in safflower. Williston,2009. Neil Riveland

'MonDak'safflower was planted on May 6 into land planted to lentils in 2008 with a drill having 7 inch row spacing, seeding at 30 lbs/a. All treatments were applied postemergence on June 5 to 4-5 leaf safflower,1-2 Russian thistle (Ruth) and common lambquarters (Colq) and 2-4 leaf green foxtail (grft). Air temperature was 52 deg F, soil temperature of 66 degrees, 10% clear sky, wind from 27 degrees at 1-4 mph and 38% RH. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 10 gals/a at 40 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 30 ft plots. First rain received after application was 0.34 inches on June 6. The experiment was a randomized complete block design with three replications. Plots were evaluated for crop injury on June 14 and July 11 for crop injury and July 11 for weed control. Population densities of Ruth were 1/2-2 plts/ft2 and grft were 5-7plts/ft2. Safflower was machine harvested on September 24.

Treatment a	Product Rate oz/a	% Crop Injury 6/14	7/11	% Control Ruth ---6/14--	Grft	Test Weight lbs/b	Yield lbs/a	Seed Oil %OD
AssureII+HrmGT+COC	8+0.2+1%	6	2	55	97	39.7	1594	32.3
Poast+HrmGT+COC	16+0.2+1%	5	3	33	98	36.7	1203	31.1
SelectMax+HrmGT+NIS	9+0.25+0.25%	8	2	50	98	38.1	1528	31.9
SelectMax+HrmGT+NIS	9+0.3+0.25%	7	1	60	98	37.9	1414	31.2
Harmony GT+NIS	0.2+0.25%	2	2	33	0	39.8	1371	32.4
Harmony GT+NIS	0.25+0.25%	3	0	43	0	40.9	1419	33.1
Harmony GT+NIS	0.3+0.25%	2	0	58	0	39.5	1541	32.4
Harmony GT+NIS	0.4+0.25%	1	1	47	0	39.2	1316	31.9
HrmGT+Everest+NIS	0.2+0.5+0.25%	13	7	65	93	38.5	1392	32.1
Glean+NIS	0.25+0.25%	0	1	48	48	38.6	1467	31.8
HarmonyGT+Glean+NIS	0.2+0.2+0.25%	3	8	70	75	40.0	1524	32.5
Ally+NIS	0.1+0.25%	7	8	68	70	39.6	1649	32.5
HarmonyGT+Ally+NIS	0.2+0.075+0.25%	6	8	57	42	37.9	1313	31.2
Untreated Check	0	0	0	0	0	39.8	1265	32.8
EXP MEAN		4	3	49	51	39.0	1428	32.1
C.V. %		79	143	36	24	4.0	12	2.3
LSD 5%		6	NS	30	21	NS	NS	NS

a - NIS = Activator 90 AND MSO from Loveland.
COC - Herbimax from Loveland

Early season injury accentuated by cool temperatures. No treatment gave satisfactory Russian thistle control.

Spartan in Sunflower. Zollinger, Richard K., Jerry L. Ries, and Angela. J. Kazmierczak. A study was conducted near Valley City, ND, to evaluate Spartan formulations applied PRE in sunflower. Pioneer '63N82' was planted on May 18, 2009 followed by the application of PRE treatments at 10:30 am with 71 F air, 50 F soil at a four inch depth, 36% relative humidity, 5% cloud cover, 4 to 8 mph N wind, dry soil surface and moist subsoil. Soil characteristics were: 41.2% sand, 41.6% silt, 17.2% clay, loam texture, 6.0% OM, and 7.9 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foots plot with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet nozzles. The experiment had a randomized complete block design with three replicates per treatment.

No crop injury was observed (data not shown). (Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Spartan in Sunflower (Zollinger, Ries, and Kazmierczak).

		21 DAA			
Treatment	Rate	Fxtl	Rrpw	Colq	Mael
	(product/A)	---------- % control ----------			
Spartan Advance	42fl oz	40	99	99	57
Spartan Charge	7.5 fl oz	60	99	99	70
Prowl H_2O	3pt	87	99	98	33
Spartan Guard	3.21pt	67	99	99	53
Spartan Guard	3.68pt	87	99	99	60
Untreated		0	0	0	0
LSD (0.05)		12	NS	2	16

Conventional sunflower tolerance to PRE herbicides. Jenks, Willoughby, and Hoefing. Non-herbicide tolerant sunflower was planted May 27 at 20,000 seeds/A into 30-inch rows in a conventionally tilled field. Herbicides treatments were applied preemergence (PRE) on May 28. The sunflower did not emerge well, so the plot area was over-sprayed with glyphosate and 'Croplan 378 DMR' was replanted on June 12. Table 1 contains the data for the application on May 28, while Table 2 contains data for the application on June 13. Thus, two separate studies were conducted side-by-side. Individual plots were 10 x 30 ft and replicated three times.

The objective of the study was to evaluate conventional sunflower tolerance to Express and Affinity applied PRE. The studies showed similar results with very little crop injury from Express or Spartan tank mixes. However, more crop injury was observed where Affinity was applied PRE. This is consistent with previous studies (data not shown here). Table 1 shows a slight trend for lower yield with Affinity, while there was no yield difference in Table 2.

Table 1. Conventional sunflower tolerance to PRE herbicides (0924-1).

		Sunflower			
Treatment[a]	Rate	16-Jul	27-Aug	Yield	Test wt.
		----------% injury----------		lb/A	lb/bu
Spartan + Express	4.5 fl oz + 0.5 oz	2	0	1951	30.0
Spartan + Affinity TM	4.5 fl oz + 0.6 oz	27	6	1723	28.2
Spartan + Prowl	4.5 fl oz + 2 pt	0	0	2188	29.3
Untreated		0	0	1898	29.8
LSD (0.05)		12.8	NS	NS	1.0
CV		89	0	11	1.7

[a] *Sunflower planted on May 27 and treatments applied on May 28; Sunflower was replanted on June 12.*

Table 2. Conventional sunflower tolerance to PRE herbicides (0924-2).

		Sunflower			
Treatment[a]	Rate	16-Jul	27-Aug	Yield	Test wt.
		----------% injury----------		lb/A	lb/bu
Spartan + Express	4.5 fl oz + 0.5 oz	3	0	1928	28.8
Spartan + Affinity TM	4.5 fl oz + 0.6 oz	13	7	1950	28.0
Spartan + Prowl	4.5 fl oz + 2 pt	4	0	1894	28.1
Untreated		0	0	1990	28.1
LSD (0.05)		NS	1	NS	NS
CV		108	35	12	3.7

[a] *Sunflower planted June 12 and treatments applied on June 13.*

Sunflower tolerance to Assert tank mixes applied at two timings. Jenks, Willoughby, and Hoefing. 'Croplan 378 DMR' sunflower was seeded June 12 at 20,000 seeds/A into 30-inch rows in a conventionally tilled field. Herbicides treatments were applied at the 4-6 leaf stage on July 2 or at the 10-leaf stage on July 14. Individual plots were 10 x 30 ft and replicated three times. Spartan + Prowl were applied preemergence to control weeds.

The objectives of this study were to 1) evaluate sunflower tolerance to Assert applied with NIS compared to Assert tank mixed with a grass herbicide (Select Max) and oil adjuvant (MSO); 2) determine the influence of an early application (4-6 leaf) vs. a late application (10-leaf); and 3) determine the effect of spray boom height above the canopy (18, 12, and 6 inches). There was less visual crop injury where Assert was applied with NIS at the 4-6 leaf stage. Sunflower yield with Assert + NIS averaged 224 lb/A more than Assert + Select Max + MSO. Sunflower yield with Assert applied at the 4-6 leaf stage averaged 238 lb/A more than when applied at the 10-leaf stage, despite the fact that two treatments with the most deformed heads were applied at the 4-6 leaf stage. Boom height did not affect sunflower yield.

Table. Sunflower tolerance to Assert tank mixes applied at two timings (0919).

				Sunflower				
Treatment[a]	Rate	Timing	Boom height	Jul 16	Jul 24	Deformed heads	Yield	Test wt.
			inches[b]	-------% injury--------		---%---	lb/A	lb/bu
Select Max + NIS	9 fl oz + 0.25%	4-6 leaf	18	0	0	0	2434	28.0
Assert + NIS	0.8 pt + 0.25%	4-6 leaf	18	2	0	1	2515	28.3
Assert + NIS	0.8 pt + 0.25%	10-leaf	18	0	4	0	2520	28.1
Assert + NIS	0.8 pt + 0.25%	4-6 leaf	12	2	0	0	2447	27.6
Assert + NIS	0.8 pt + 0.25%	10-leaf	12	0	5	0	2295	28.4
Assert + NIS	0.8 pt + 0.25%	4-6 leaf	6	2	0	1	2584	27.6
Assert + NIS	0.8 pt + 0.25%	10-leaf	6	0	8	1	2356	27.6
Assert + Select Max + MSO	0.8 pt + 9 fl oz + 1%	4-6 leaf	18	5	2	14	2155	27.4
Assert + Select Max + MSO	0.8 pt + 9 fl oz + 1%	10-leaf	18	0	13	4	2242	27.6
Assert + Select Max + MSO	0.8 pt + 9 fl oz + 1%	4-6 leaf	12	6	3	10	2458	26.8
Assert + Select Max + MSO	0.8 pt + 9 fl oz + 1%	10-leaf	12	0	15	2	2050	28.1
Assert + Select Max + MSO	0.8 pt + 9 fl oz + 1%	4-6 leaf	6	5	2	2	2598	27.7
Assert + Select Max + MSO	0.8 pt + 9 fl oz + 1%	10-leaf	6	0	17	7	1869	28.2
Select Max + NIS	9 fl oz + 0.25%	4-6 leaf	18	0	0	0	2476	29.0
LSD (0.05)				0.7	1.1	3.7	377	1.3
CV				27	14	74	10	2.8

[a] *No sunflower injury was observed in any treatment on August 24th.*

[b] *The number of inches the boom was held above the canopy at application*

Canada thistle control in sunflower. Howatt, Roach, and Harrington. 'Pioneer 63N82' sunflower was seeded near Fargo on May 29. Treatments 1 through 5 and the first half of treatments 11 and 12 were applied to cotyledon to two-leaf sunflower, one- to five-leaf common mallow (10 to 30/yd^2), cotyledon to six-leaf wild mustard (50 to 150/yd^2), one- to four-leaf wild buckwheat (5 to 20/yd^2), and 1- to 4-inch Canada thistle (1 to 20/yd^2) on June 15 with 77° F, 55% relative humidity, 95% cloud cover, 6.5 mph wind velocity at 135°, and dry soil at 64° F. Treatments 6 through 10 and the second half of treatments 11 and 12 were applied to four-leaf sunflower, 4- to 12-inch Canada thistle (1 to 20/yd^2), 2 to 8 leaf wild buckwheat (5 to 40/yd^2), and cotyledon to bolting wild mustard (2 to 50/yd^2) on June 24 with 79° F, 51% relative humidity, 30% cloud cover, 4 mph wind at 180°, and damp soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 1001 TT nozzles to an area 7 feet wide the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		6/26	6/26	6/26	6/26	6/26	7/6	7/6	7/6	7/11	7/11	7/11	7/20	7/20	8/04	8/04
Treatment	Rate	Sunflower	Canada thistle	Wild buckwheat	Wild mustard	Common Mallow	Canada thistle	Wild buckwheat	Wild mustard	Canada thistle	Wild buckwheat	Wild mustard	Canada thistle	Wild buckwheat	Canada thistle	Wild buckwheat
	oz/A	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Immx+NIS+AMS	0.5+0.25%+40	3	84	80	94	86	82	80	99	76	72	99	60	67	55	77
Immx+NIS+AMS	0.75+0.25%+40	3	84	81	94	89	86	87	99	82	77	99	69	67	60	77
Immx+MSO+AMS	0.5+1%+40	3	86	84	94	90	86	86	99	85	86	99	79	85	62	76
Immx+MSO+AMS	0.75+1%+40	3	86	85	95	91	87	88	99	89	89	99	82	87	74	88
Trib-sg+MSO	0.25+1%	3	92	94	94	87	86	86	99	86	91	98	86	92	70	92
Immx+NIS+AMS	0.5+0.25%+40	3					60	75	87	60	76	96	84	80	80	70
Immx+NIS+AMS	0.75+0.25%+40	3					82	77	91	79	79	95	84	85	79	66
Immx+MSO+AMS	0.5+1%+40	3					81	80	92	80	82	95	85	89	81	72
Immx+MSO+AMS	0.75+1%+40	3					85	81	91	86	85	97	90	91	80	74
Trib-sg+MSO	0.25+1%	3					87	89	94	87	87	97	91	89	86	90
Immx+MSO+AMS/ immx+MSO+AMS	0.5+1%+40/ 0.5+1%+40	3	65	84	94	90	92	93	99	93	93	99	92	94	91	95
Trib-sg+MSO/trib-sg+MSO	0.25+1%/0.25+ 1%	3	66	94	94	89	92	97	99	92	96	99	88	96	92	98
Untreated	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CV		0	28	4	3	4	15	6	2	15	4	1	6	6	9	12
LSD 5%		0	29	4	4	5	17	7	3	17	4	2	7	7	10	13

Treatment application earlier in the season to 4 inch thistle did not provide the best control but removing thistle competition allowed for better crop development and established greater potential for yield. Higher rate of imazamox or inclusion of a more aggressive adjuvant system tended to enhance weed control but did not always improve weed control. The split-application program gave the greatest weed control, but total herbicide use was twice that of single application treatments.

Common cocklebur control in ExpressSun sunflower. Zollinger, Richard K., Jerry L. Ries, and Angela. J. Kazmierczak. An experiment was conducted near Prosper, ND, to evaluate Express SG treatments in sunflower to control common cocklebur. Pioneer '63N82' ExpressSun sunflower was planted on May 28, 2009 followed by the PRE application of Prowl H_2O at 3.8pt/A across the entire study area. Soil characteristics were: 28.7% sand, 49.7% silt, 21.6% clay, loam texture, 4.2% OM, and 7.2 pH. EPOST applications were made on June 26 at 9:25 am with 74 F air, 74 F soil surface, 57% relative humidity, 10% clouds, 7 to 9 mph S wind, dry soil surface, wet subsoil, good crop vigor and no dew present to V4 to V6 (6 to 8 inch) sunflower. Weed species present at the time of EPOST applications were: 0.5 to 4 inch (5 to 30/yd^2) common ragweed; 2 inch (1/yd^2) common cocklebur; and 0.5 to 3 inch (5 to 25/yd^2) redroot pigweed. MPOST applications were made on July 8 at 11:30 am with 74 F air, 86 F soil surface, 53% relative humidity, 0% clouds, 4 to 7 mph S wind, dry soil surface, wet subsoil, excellent crop vigor and no dew present to V6 to V8 (18 to 24 inch) sunflower. Weed species in MPOST plots were: 1 to 6 inch (5 to 8/yd^2) common ragweed; 1 to 3 inch (1/yd^2) common cocklebur; and 0.5 to 2 inch (1 to 3/yd^2) redroot pigweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plot with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 11001 Turbo TeeJet nozzles for all treatments. The experiment had a randomized complete block design with three replicates per treatment.

No sunflower injury was observed (data not shown). Sunflower control requires Express applied in two successive applications each applied at the highest rate (0.5 oz/A) with MSO adjuvant.
(Dept of Plant Sciences, North Dakota State University, Fargo).

Table. Common cocklebur control in ExpressSun sunflower (Zollinger, Ries, and Kazmierczak).

		July 10			July 17			July 24 and August 7		
Treatment	Rate	Rrpw	Corw	Cocb	Rrpw	Corw	Cocb	Rrpw	Corw	Cocb
	(product/A)									
EPOST										
Express SG+Scoil	0.25oz+1% v/v	95	52	52	75	67	52	75	67	52
Express SG+Scoil	0.5oz+1% v/v	95	60	70	98	78	76	98	78	73
EPOST/MPOST										
Express SG+Scoil/ Express SG+Scoil	0.25oz+1% v/v/ 0.25oz+1% v/v	95	55	70	96	73	75	96	73	75
Express SG+Scoil/ Express SG+Scoil	0.5oz+1% v/v/ 0.5oz+1% v/v	95	67	73	98	82	88	98	82	88
LSD (0.05)		1	8	5	6	8	7	6	8	7

Performance of Sharpen as a preharvest desiccant in sunflower, Carrington, 2009. (Greg Endres and Paul Hendrickson). The field experiment was conducted in cooperation with BASF at the NDSU Carrington Research Extension Center to test Sharpen (saflufenacil) for effectiveness as a preharvest desiccant in sunflower. The experimental design was a randomized complete block with three replicates. Mycogen '8N386CL' sunflower was planted at 26,000 seeds/A in 30-inch rows on May 19. Best management practices were used for sunflower production. Preharvest treatments were applied on September 29 with a tractor-mounted CO_2 sprayer with 015F110 flat fan nozzles delivering 13 gal/A at 30 psi with 44 F, 81% relative humidity, and 10 mph wind to R9 stage (physiologically mature) sunflower at 35% seed moisture. Two hours of 30-31 degree F occurred on September 29 prior to application of desiccants and a minimum air temperature of 22 degrees F occurred on October 8. Visual evaluation of sunflower plant desiccation was conducted on October 7 and 15. The trial was harvested on November 13 with a plot combine.

Sharpen and Gramoxone Inteon generally increased whole plant and leaf tissue desiccation 8 days after application (DAA) compared to the untreated check (Table). The tank mixture of glyohosate with Sharpen did not increase tissue desiccation compared to Sharpen. Plant tissue throughout trial was uniformed desiccated on October 15 (16 DAA) due to low temperatures beginning October 8. Seed yield, moisture and quality were similar among treatments.

Table.

Herbicide		Sunflower desiccation (7-Oct)			Sunflower seed			
		Whole plant	Leaves	Heads	Yield	Moisture	Test weight	Oil
Treatment[1]	fl oz product/A	% brown tissue			lb/A	%	lb/bu	%
untreated check	x	38	40	27	1082	10.3	28.2	36.6
glyphosate+NIS+AMS	24+0.25%v/v+64	42	45	28	992	11.0	27.2	36.7
Sharpen+glyphosate+MSO+AMS	1+16+1%v/v+64	50	58	32	1338	10.6	28.4	37.3
Sharpen+MSO+AMS	1+1%v/v+64	48	57	32	1264	10.8	28.2	37.9
Sharpen+MSO+AMS	2+1%v/v+64	42	47	35	1136	10.7	28.0	36.7
Gramoxone Inteon+NIS	24+0.25%v/v	53	63	33	1213	10.3	27.6	36.2
mean		46	52	31	1171	10.6	27.9	36.7
C.V. (%)		12	15.1	11.2	17.8	3.8	1.7	3.4
LSD (0.05)		10	14	NS	NS	NS	NS	NS

[1]Glyphosate=GlyStarPlus, 3 lb ae/gal (Albaugh); NIS=Preference (Winfield Solutions); AMS=N-Pak AMS liquid (Winfield Solutions); MSO=Destiny (Winfield Solutions).